

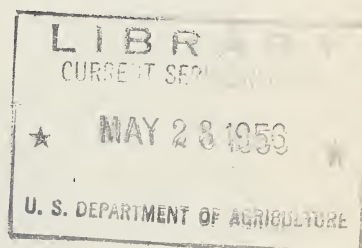
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Citrus Industry

of BRITISH HONDURAS
JAMAICA
TRINIDAD



Foreign Agriculture Report No. 88

U. S. DEPARTMENT OF AGRICULTURE
Foreign Agricultural Service

FOREWORD

This study is a part of a continuing analysis of world citrus industries that the Foreign Agricultural Service is making in the interest of the United States citrus industry.

The study was undertaken in mid-1955, when a problem arose concerning the competition of British West Indies citrus with United States fruit in the United Kingdom market.

A handwritten signature in cursive script that reads "Donald M. Rubel". The signature is written in dark ink and is positioned above the printed name and title.

Don M. Rubel, Director
Fruit and Vegetable Division
Foreign Agricultural Service

ACKNOWLEDGEMENTS

The author wishes to acknowledge the helpfulness and many kindnesses shown him by officials of the governments and the citrus industries and others in British Honduras, Jamaica, and Trinidad.

April 1956

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Citrus Industry

BRITISH HONDURAS, JAMAICA, AND TRINIDAD

by J Henry Burke, Marketing Specialist
Foreign Agricultural Service

PART I. BRITISH HONDURAS

British Honduras, the only English-speaking country in Central America, contains an area of about 8,900 square miles and is located on the Gulf of Mexico south of Mexico and north of Guatemala. The first settlement was made in 1638 by a party of shipwrecked British seamen; and in 1862 British Honduras was designated as a British Colony.

In 1955 the population of the Colony was an estimated 84,000 persons. About 35,000 of them live in the capital city, Belize.

British Hondurans have never been greatly interested in agriculture. Farming on a commercial scale is a new enterprise. Their country is largely forested and famous for such hard woods as mahogany, rosewood, Santa Maria, cedar, and pine. Lumber and chicle have been important exports. In recent years, however, the largest exports in terms of value have been grapefruit and grapefruit juice. Some coconuts, bananas, and fish are also exported, however.

SUMMARY

British Honduras has the best citrus-growing conditions in the Caribbean area. It has produced small quantities of grapefruit for many years, but extensive Valencia orange plantings since 1948 will one day make oranges its most important citrus crop. The 1954 crop of 80,000 boxes of oranges and 315,000 boxes of grapefruit will probably increase to 900,000 boxes of oranges and decrease to 250,000 boxes of grapefruit a year by 1960.

Favorable soil conditions and a subtropical climate result in high yields--grapefruit averaging 300 boxes per acre.

British Honduran citrus fruit is juicy and thin-skinned, of

tropical quality and large size. Both oranges and grapefruit have a green color when mature.

A modern citrus-processing plant has been built at Pomona on Stann Creek. Its production of single-strength orange and grapefruit juice, concentrated juice, grapefruit sections, and essential oils is exported, almost entirely to the United Kingdom. Orange juice concentrate will be its most important export product in the future.

Fresh fruit, primarily grapefruit, is exported in September and October. Export marketing costs are high; in 1954, it cost approximately \$3.55 per box to pick, pack, and ship a box of grapefruit to England.

Most new citrus plantings have been made on virgin soil cleared from the jungle. The annual dry season in February and March sometimes extends to June, injuring the citrus trees. Irrigation, not now practiced in the major producing area--the Stann Creek Valley--may be necessary for consistent commercial yields.

In addition to the drought, and the fire hazard created by the drought, hurricane damage is possible.

Gummosis is the most important disease, and important pests are leaf-cutting ants, wasps, moles, the Mexican fruit fly, and parrots.

British Honduran citrus groves are large and are mostly cultivated by a turf culture at a cost, estimated in 1954, of about US\$100 an acre.

FRESH FRUIT

Cultural Conditions

Commercial agriculture on a large scale was first attempted in British Honduras from 1908 to about 1920, when commercial plantings of bananas were established in the Stann Creek Valley. Wind and disease stopped this industry. Since that time the production of citrus is the first large-scale industry to be developed.

A part of the present citrus plantings are at Middlesex on old banana plantation land. More than half of the newly planted acreage is on land cleared from the jungle. The largest plantations are extensive and continuous. The valley is alluvial land containing pockets of sand. These sandy areas are good citrus land and reduce the incidence of gummosis.

Each year a drought is experienced from February to April. During this time the citrus plants on the sandy soil suffer from lack of moisture. The oranges seen in June 1955 were in their worst condition. Some trees on light soils were completely wilted. Some of the plantings on sand probably will have to be abandoned unless supplemental irrigation is used. In general, however, the leaf population on both orange and grapefruit trees was good and it was impossible to see through most trees.

In the Stann Creek Valley, citrus is raised at elevations from 100 to 500 feet. The small citrus plantings in Cayo are at an elevation over 200 feet.

Citrus trees grow rapidly in the Stann Creek Valley. Grapefruit trees 25 years of age have trunks 10 to 12 inches in diameter and a spread of at least 30 feet. A 6-year-old orange tree produces two to four boxes of fruit.

Climate. --There is a great variation in rainfall in British Honduras. In the 20 years from 1930 to 1950 the annual rainfall at Middlesex on Stann Creek ranged from a low of 71 inches to a high of 158 inches a year.

The effect of climate on citrus bloom is most interesting. In contrast to the other Caribbean citrus areas of Jamaica and Trinidad, which have strictly tropical climates and where the bloom is controlled by rainfall, British Honduras has a subtropical climate in which some citrus bloom is controlled by temperature and some by rainfall.

Oranges bloom twice in British Honduras--first in December and January and again in April and May, after the beginning of the rainy season. Grapefruit usually blooms in February and March and again between May and July.

Grapefruit matures 7 months after the bloom; trees blooming in February have ripe fruit in September and October. Valencia oranges require 10 to 11 months to mature; trees blooming in December and January have ripe fruit by November and the following December. Early orange varieties, such as the Washington navel and Hamlin, require only about 8 months from bloom to maturity; those that bloom in late December and April produce fruit that matures from August to February.

The blooms occurring from April to July are caused by the rain which breaks the drought of February and March (tables 1 and 2). The early bloom in December-January is caused by temperature; the trees dormant in the cool December weather bloom as the temperature rises toward the end of December.

Hurricanes occur infrequently but have done severe damage. One of the most damaging was the storm of 1931, which struck Belize with wind velocity of 132 miles an hour. Other hurricanes causing less damage were reported in the southern part of the Colony in 1916, 1942, and 1954, and in the northern part in 1944.

The most frequent climatic hazard is drought, and the non-irrigated areas on Stann Creek can be severely damaged by lack of rainfall from February to June. During the drought the forest-surrounded groves face the additional hazard of fire. In June 1955, firebreaks were being cut through groves in the area, but widespread damage was being done by extensive forest fires. The abundance of dry grass in the groves multiplies the fire hazard.

Pests. --British Honduras has many citrus pests. It has such common ones as the aphids of the black type, said to be the vector of tristeza. And it has several citrus scales, including Florida red and West Indian scales; but, since most citrus groves are near heavily forested areas, a satisfactory biological control of the scales is usually provided by parasites and fungus that attack them. No oil spraying is done.

TABLE 1.--Climatic data at Agastat agricultural station in Stann Creek, British Honduras, 1952

Month	Rainfall	Average humidity	Average temperature	
			Maximum	Minimum
	<i>Inches</i>	<i>Percent</i>	<i>°F.</i>	<i>°F.</i>
January.....	6.75	90	82	67
February.....	.84	76	90	65
March.....	.43	82	87	67
April.....	11.75	80	86	69
May.....	4.07	78	88	72
June.....	8.09	81	87	73
July.....	13.13	79	87	73
August.....	8.49	79	87	73
September.....	11.79	81	89	73
October.....	9.98	77	84	70
November.....	11.01	80	83	69
December.....	5.88	82	80	65
Total.....	92.21			

Source: British Honduras Department of Agriculture.

TABLE 2.--Monthly rainfall at three stations on Stann Creek compared with that of Cayo, 1952

[[In inches]]

Month	Stann Creek stations			Cayo
	Agastat	Pomona	Middlesex	
January.....	6.75	6.92	6.29	1.73
February.....	.84	1.13	.43	.66
March.....	.43	1.35	--	1.03
April.....	11.75	12.27	7.72	2.09
May.....	4.07	1.87	2.89	1.48
June.....	8.09	9.59	18.30	7.49
July.....	13.13	13.52	16.91	8.34
August.....	8.49	12.83	14.86	3.77
September.....	11.79	12.03	7.45	1.79
October.....	9.98	9.74	11.83	13.99
November.....	11.01	5.36	8.27	6.87
December.....	5.88	4.67	4.27	1.51
Total.....	92.21	91.28	99.22	50.75

Source: British Honduras Department of Agriculture.

The most common pest in British Honduras is the wee wee ant (*Atta cephalotes*). This is a leaf-cutting ant that can defoliate a tree in a day. It is controlled by Chlordane and Aldrex.

The fiddler beetle is also to be found. It lives on the tree, laying eggs in a web from which the larvae drop to the ground, where they live for about 7 months. During this period the larvae eat the bark of the roots of citrus trees and often girdle and kill young orange trees. It is a most difficult pest to combat, for growers are not aware of its attack until a tree shows signs of damage. Measures of control involve planting trees on mounds and, when they are about 2 years old, exposing the major framework of the roots. This limits the damage that the beetle can do and offers an opportunity to discover the infestation before the tree is killed.

Another pest is the Drunken Bayman Wasp (*Melipona* sp.), a leaf-sucking pest that attacks new foliage.

A less serious pest is the tree termite, which builds a mud nest in trees and lives on dead wood. These have a nuisance value but do no serious damage.

The areas of citrus production are also subject to periodic infestations of the 17-year locust. The next occurrence is expected in 1958. Control measures are made difficult by the denseness of the forests surrounding the citrus groves; nothing can be done until the locusts move out into the cultivated area. Spraying the young insects with Diesel oil has brought a good degree of control.

In addition to the pests that attack trees, two attack the fruit. The most important is the Mexican fruit fly, which causes greater damage to grapefruit than to oranges. It lays its eggs in the mature fruits. The larvae mature in the fruit, making it unsuitable for use either as fresh fruit or in processing. This fly can be partly controlled by spraying; but no control measures are being taken as yet in British Honduras. The presence of this pest limits the markets to which British Honduras citrus fruits can be exported since some markets, such as the United States, have a quarantine against pests of this type.

Rather unusual pests are the parrots, which inhabit the forest and are said to be fond of grapefruit. They invade the groves by the thousands when the fruit is ripe. The damage they do is not confined to the fruit they eat, for they often cut several additional fruits from the tree.

British Honduras also has a ground mole that damages the roots of young citrus trees.

With the exception of the Mexican fruit fly and the locusts, most of the pests of citrus in British Honduras do not require general control measures; rather, they require frequent inspection of the groves and control where an infestation occurs.

Diseases. -- The most important citrus disease in British Honduras is gummosis. It attacks the older trees and has killed many grapefruit trees in the orchards planted since 1930. The disease is most active in the heavy soils. It is active even on trees budded on sour rootstock; but, should



Staked budded trees ready for orchard planting at the Department of Agriculture citrus nursery near Pomona, British Honduras.

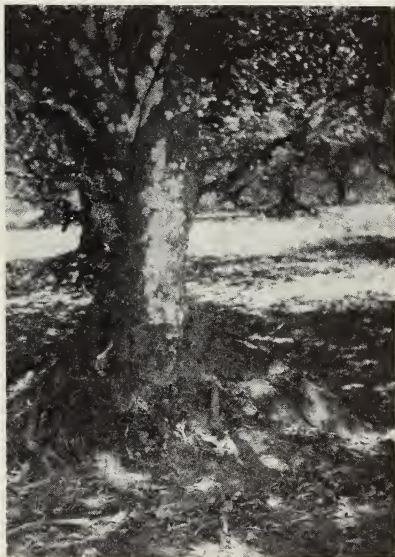
Many of the older grapefruit trees are showing signs of decline, which may indicate decreased production.



Young Valencia grove in the Stann Creek Valley, planted for the U. K. Ministry of Food orange juice contract.



This 5-year-old orange grove near Middlesex shows the turf cultivation through which firebreaks are cut in the dry season.



To stop the spread of disease, a trench is cut around the stump of a dead grapefruit tree (left). Grapefruit tree planted in a mound as protection against fiddler beetle (right).

tristeza infect the groves, it would be difficult to use other types of rootstock, for none is so resistant to gummosis as sour rootstock. In some diseased areas, cattle are grazed in the groves to raise the limbs from the ground and thus obtain better ventilation of the trunk area to retard gummosis.

Psorosis is reported in oranges in British Honduras, but no outbreaks were observed. Most of the orange trees are young, however, and the extent of the infection may not be evident until they mature. Too, trees were obtained in the United States before disease-free bud selection was the general practice; therefore, it may be assumed that psorosis is present.

The old grapefruit groves are infected with a decline disease, which may cause a complete collapse in a few weeks. It spreads throughout the ground from one tree to another. To stop the spread of the disease, trenches are dug around infected trees. At first it was thought to be tristeza, but tests of the roots have been made and it is not. The effect of the disease appears similar to that of the oak root fungus in California and the "spreading disease" in Florida.

Citrus scab is present in all citrus-producing areas, and the heaviest infestation was noted on young orange trees.

Varieties. --The major plantings of oranges consist of the Valencia variety. All the plantings made to provide juice for the concentrate called for in the British Ministry of Food contract are of this type. There are small plantings of early oranges such as Washington navel, Parson Brown, and Hamlin.

Nearly all grapefruit is the Marsh seedless variety; a few commercial orchards have Duncan grapefruit.

Nurseries. --The extensive plantings made since 1948 have been supplied with trees from three sources. The Colonial Development Corporation and the Citrus Company of British Honduras, Ltd., raise trees for their own groves, and the Department of Agriculture operates two nurseries, one in the Stann Creek area and another at Central Farm near Cayo. The trees raised by the Department of Agriculture are sold to the small growers at a price of US\$.18. The probable cost of production averages about US\$.25 per plant.

The most common rootstock is sour orange; but small quantities of trees have been raised by the Department of Agriculture on rough lemon rootstock. In the government nurseries, new land is chosen for each year's planting, and the budded trees are staked and trained. Some of the trees raised in private plantations are not trained. It is the usual practice to plant bare root. The trees are usually budded about 12 inches from the ground and the quality of the nursery trees seen in both government and private plantations was the best seen in the Caribbean.

Nearly all the trees being raised are budded to the Valencia orange. Only a few grapefruit trees are being produced as replacements.

Governmental Experiment Work. --A central agricultural

station to carry on experimentation and assistance to growers was established only 5 years ago in Central Farm at Baking Pot near Cayo. It represents the first organized effort to obtain data of value to agriculture and to begin experiments in citrus. The Department of Agriculture publishes an excellent report each year, which gives economic and cultural data on British Honduran agriculture.

Trial plots for fertilizer experimentation, including the use of minor elements, have been established. It is too early for determinations, but both mineral fertilizers and cover

TABLE 3.--Estimated orange and grapefruit production, British Honduras, 1949-54

[In thousands of boxes]

Year	Oranges	Grapefruit
1949.....	10.5	275
1950.....	7.5	255
1951.....	12.0	345
1952.....	12.0	335
1953.....	35.0	200
1954.....	80.0	315

TABLE 4.--Acreage in oranges and grapefruit at the end of 1953, by district, British Honduras

Item	Stann Creek	Northern districts	Other areas	Total
Oranges:	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
Bearing.....	59	405	300	764
Nonbearing.....	2,754	57	--	2,811
Total.....	2,813	462	300	3,575
Grapefruit:				
Bearing.....	722	120	175	1,017
Nonbearing.....	4	3	--	7
Total.....	726	123	175	1,024
Limes ¹	--	--	400+	400+

¹ Groves only. Limes grow wild over a wide area.

Source: British Honduras Department of Agriculture.



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crops such as tropical kudzu have shown satisfactory results. The citrus industry has little information on citrus scales and only the beginnings of a study of these pests have been made. (No serious scale infestation was seen on visits to citrus orchards.)

Experiments with various types of rootstocks resistant to tristeza have been started by the introduction of seed of resistant varieties.

Production

Until World War II the commercially important citrus plantings were largely in grapefruit. During the war, however, a long-term contract with the British Ministry of Food for orange juice concentrate stimulated the planting of a large acreage to oranges. Today the British Honduras citrus industry consists primarily of full-bearing grapefruit orchards, many of which show signs of decline, and young nonbearing Valencia orange orchards.

Half of the total citrus acreage in British Honduras is in two properties. The Citrus Company of British Honduras, Ltd., owns about 1,450 acres of oranges and 482 acres of grapefruit; the Colonial Development Corporation owns 506 acres of oranges. In all, there are fewer than 70 growers in the Colony, and some 25 growers produce 90 percent of the crop.

Orange production began to increase in 1953 and reached an estimated 80,000 boxes in 1954. Production in 1955 may not show an increase, owing to the severe droughts that continued until June. The young orchards will rapidly come into bearing and a potential production of 900,000 boxes per year is possible by 1960. Supplemental irrigation will probably be necessary to reach this production level, however.

Grapefruit production has been maintained at 200,000 to 345,000 boxes a year. In the future, it may decrease as old trees go out of production. A crop of 250,000 boxes is estimated for 1960.

There are no official citrus production data in British Honduras. Estimates of the orange and grapefruit crops from 1949 to 1954 are provided in table 3; the data refer to the production of fruit resulting from the bloom beginning in January of each year. These estimates are based on the utilization of fruit in each year and assume a domestic consumption of 6,000 boxes of oranges and 2,000 boxes of grapefruit per year. This is small, but is probably generous, considering both the small population and poor transportation in the interior area.

Districts. --The major citrus area in British Honduras is in the Stann Creek Valley, located about 35 air miles south of Belize. By road through the coastal swamps, the distance is about 100 miles. Nearly all the old grapefruit groves and most of the young nonbearing orange orchards are here.

A second area of production is near Cayo, about 60 miles inland from Belize, at an elevation of about 200 feet.

The original orange-producing area is located near Corozal. Acreage. --More than 3, 500 acres are planted to oranges, with nonbearing trees covering some 2, 800 acres. Within the next 5 years, another 1, 200 acres of oranges will be planted.

Nearly all the 1, 000 acres of grapefruit are of bearing age, and new plantings in the next 5 years will amount to less than 130 acres.

Limes grow over wide areas in British Honduras, but in 1953 only 400 acres had been planted in a commercial orchard.

Yields. --Because of seasonal temperatures that induce a period of dormancy and because of good soil conditions, citrus yields in British Honduras are above the average for the Caribbean area. The 315, 000-box grapefruit crop in 1954 was raised on about 1, 000 acres, with an average yield of about 300 boxes an acre. A few groves have considerably higher production, and trade sources indicate that yields of 1, 000 boxes per acre are possible.

Meaningful yield figures are not available for most orange orchards; they are as yet too young. But 5-year-old orchards have produced 300 boxes per acre; and the condition of the trees, with large leaves and heavy foliage, indicates that good yields may be expected.

For both grapefruit and oranges, sustained high yields in the Stann Creek Valley and Cayo would appear to depend on supplemental irrigation during the annual spring dry season. An examination of rainfall records certainly indicates the need.

Labor Requirements. --Labor is comparatively expensive in British Honduras. The large estates, which use mechanical seed cutters, are said to have about one permanent employee for every 20 acres. But considering the industry as a whole, the annual labor requirements for cultivation may be estimated at around 500 workers--about one employee for every 10 acres planted and an additional 1, 000 seasonal workers. Not more than 1, 500 persons are at present employed in cultural operations in the citrus industry.

In the packinghouses and processing plant at Pomona, an estimated 800 persons are employed; this figure takes into account the several shifts that are working when the plant is in full operation.

The total amount of labor employed in the citrus industry in both cultivation and marketing activities and in seasonal work may be estimated at around 2, 300; at least two-thirds of them are only seasonal workers.

Costs. --In 1954, it is estimated that the cost of operating an acre of citrus in British Honduras was about US\$98. If we consider that the average grapefruit grove produces about 300 boxes per acre, or about 4 boxes per tree, the average cost of production was about US\$.33 per box. At this time, it is impossible to estimate orange production costs, but it may be assumed that they will be slightly higher than for grapefruit, since the average yield of oranges will probably be less than of grapefruit.

Some of the 1954 cultural and packing costs are given in the tabulation on page 14. These costs appear moderate and will probably remain so, for the higher citrus yields obtained in British Honduras keep unit costs lower than those in other British West Indian citrus-producing areas.

The Fact-Finding Mission¹ estimated that the cost of production for oranges on the tree was about US\$.39 per box and that for grapefruit, US\$.24 per box.

These costs represent the expense of caring for large well-operated groves and are therefore to be considered a fair example of cultural citrus costs, since most of the citrus property in British Honduras is large estates.

The daily wages referred to in the Mission report are representative of the wages paid for permanent year-round workers. These workers also get garden privileges, housing, wood, and water.

Marketing

Size of Fruit. --Citrus fruits grow rapidly in British Honduras, and sizes are comparable to those of Florida. As shown in the following figures (from an export shipment in 1954), British Honduran fruit tends to be large:

<u>Size</u>	<u>Number of packed boxes</u>
54.....	423
64.....	1,873
70.....	3,105
80.....	4,323
96.....	4,915
112.....	1,614
126.....	444
150.....	53

Source: The Citrus Company of
British Honduras, Ltd.

The size is a handicap for exports to Western Europe, which prefers smaller sizes. Size 54 is normally not exported.

Grade of Fruit. --Owing to fungus diseases and pests, which disfigure the fruit, a large percentage of the present export shipments have been of standard grade. For instance, one 1954 shipment of 16,500 boxes consisted of about 14,000 of standard grade, and less than 3,000 of choice grade. In another shipment, 12,500 boxes were of standard grade and 4,000 boxes of choice.

Costs. --In the 1953-54 season, marketing costs from "on the tree" to "cost and freight" England for fresh grapefruit were US\$3.55 per box:

Cost per packed box

Picking.....	US\$0.10
Transport	.07
Packing material and supplies	.97
Direct packing costs	.22
Repairs and depreciation.....	.21
Overhead.....	.34
Shipping expense	.23
Total to f. o. b.....	2.15
Freight to U.K. (refrigerated stowage).....	1.40
Total cost to U.K.....	3.55

Source: Report of the Fact-Finding Mission.

¹ "The West Indian Citrus Industry," Report of Fact-Finding Mission, Colonial No. 314, Feb. 25, 1955.

Exports. --British Honduras has exported small quantities of fresh citrus fruits for about 20 years (table 5). Grapefruit,

TABLE 5.--Export of fresh oranges and grapefruit from British Honduras, 1937-54

Year	Oranges	Grapefruit
	<i>Boxes</i>	<i>Boxes</i>
1937.....	3,429	20,793
1938.....	422	50,858
1939.....	838	61,804
1940.....	2,226	55,847
1941.....	1,746	5,810
1942.....	734	263
1943.....	2,965	6,443
1944.....	3,336	2,545
1945.....	3,592	2,260
1946.....	6,117	1,071
1947.....	2,688	874
1948.....	2,214	1,380
1949.....	2,834	86,512
1950.....	1,981	114,520
1951.....	4,949	36,697
1952.....	4,840	43,932
1953.....	5,521	41,021
1954.....	6,254	30,592

Source: British Honduras Department of Agriculture.

TABLE 6.--British Honduran exports of oranges and grapefruit by month, 1953

Month .	Oranges	Grapefruit
	<i>Boxes</i>	<i>Boxes</i>
January.....	--	--
February.....	430	60
March.....	--	210
April.....	--	--
May.....	--	--
June.....	--	--
July.....	60	--
August.....	--	--
September.....	170	28,120
October.....	950	12,580
November.....	--	--
December.....	3,900	50
Total.....	5,510	41,020

Source: Official data.

most of which goes to the United Kingdom, has been the important item. In 1950 a record 100,000 boxes were exported. Since then, fresh fruit exports have been smaller, owing to the utilization of large quantities for products. Orange exports, virtually all to Mexico, have always been smaller than those of grapefruit. The 6,254 boxes exported in 1954 was the largest on record.

Grapefruit exports promise to be maintained at about the level of the past few years. Fresh orange exports may increase as the young groves come into production.

The Citrus Company of British Honduras, Ltd., packs and ships all the fresh fruit (and products) exported to Europe. In 1954, it was using a two-compartment wire-bound Bruce box. Plant capacity is 200 packed boxes per hour, and it is run at full capacity by at least two shifts of workers when export shipments are being prepared.

Export shipments of grapefruit have to be made in lots of about 15,000 boxes since a ship must be chartered for each shipment; there are no docks at Stann Creek and the fruit must be loaded from a lighter. In addition, there are no cold-storage facilities, which necessitates bringing packed fruit to shaded storage near the coast, where it may be cooled by the prevailing coastal winds.

British Honduras has a favorable season for grapefruit exports; its early shipments--in September and October--reach European markets at a time when the Mediterranean fruit is no longer available (table 6).

In the British market, grapefruit from British Honduras

competes well with that from South Africa. For instance, British Honduran grapefruit brought an average of US\$1.40 per box more than South African fruit at the London auction sales in October 1954 (table 7), indicating the quality of the respective grapefruit.

PROCESSED FRUIT

Production

The Citrus Company of British Honduras, Ltd., operates a modern citrus-processing plant in the Stann Creek Valley at Pomona, about 14 miles from the coast. The plant is located near the center of citrus production, and most fruit is available with a minimum of transport cost. The plant's capacity is adequate to handle all the fruit likely to be available in the near future. It is well equipped with a fruit washer, a continuous de-oiler manufactured in Israel, a single-strength juice "line," and a concentrator of English manufacture. And it is equipped for canning grapefruit segments.

At present the plant is producing single-strength orange and grapefruit juice, orange and grapefruit concentrate for the British Ministry of Food contract and for the squash trade, essential oil of orange and grapefruit, grapefruit segments, and small quantities of citrus pulp. There are no facilities for utilizing peels and other plant wastes.

Attempts are being made to can other British Honduran products; in 1955, small quantities of pineapples and pineapple juice were being produced.

Plant capacity is said to be 232 cases of 24 No. 2 cans of single-strength juice per hour, and the plant is reportedly

TABLE 7.--Comparison of London auction prices per box of British Honduran and South African grapefruit

Size	October 20, 1954		October 25, 1954	
	British Honduran	South African	British Honduran	South African
	<i>U.S. dollars</i>	<i>U.S. dollars</i>	<i>U.S. dollars</i>	<i>U.S. dollars</i>
64.....	5.46	--	6.30	4.83
70.....	6.23	--	7.72	--
80.....	6.65	--	7.00	--
96.....	6.58	--	7.14	--
112.....	6.58	--	7.28	5.74
126.....	6.30	5.04	7.00	--
150.....	--	4.62	--	--

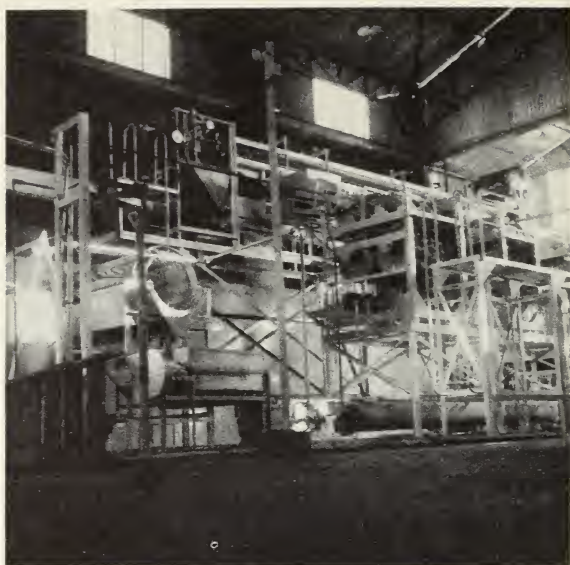
Source: Price catalogs of auction members.



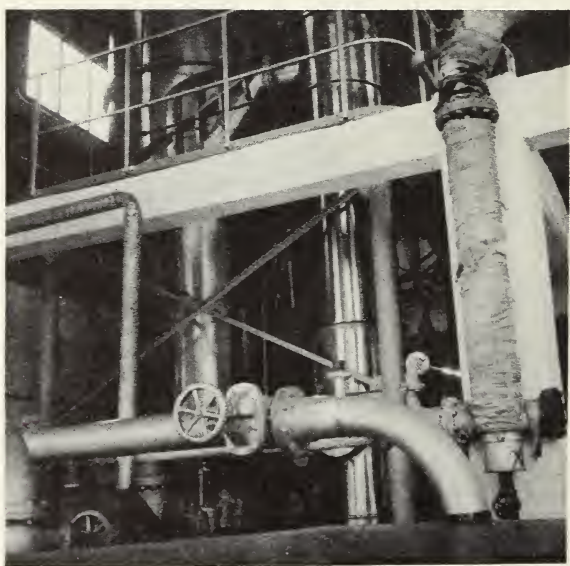
With this type of equipment, water is pumped from the Belize River to irrigate a Valencia grove near El Cayo, British Honduras.



British Honduras has only one citrus processing plant. The fruit bins of this plant, near Pomona, are pictured above.



Juice extractors at the Pomona plant. Production costs here are the highest in the British Caribbean territories.



Juice concentrator at Pomona. At present the plant is producing orange and grapefruit concentrate for Britain.

TABLE 8.--Tests of orange and grapefruit juice, British Honduras, 1954, averages for the season

Item	Natural Brix (degrees)	Acidity (percent of citric acid)	Canning Brix after adding sugar (degrees)
Grapefruit.....	9.5-10.0	1.2	13.5-14.0
Oranges.....	11.1	.93	14.0

Source: The Citrus Company of British Honduras, Ltd.

TABLE 9.--Exports of fresh and processed oranges and grapefruit from British Honduras, by country of destination, 1954

Item	Unit	United Kingdom	Mexico	Other
Oranges:				
Fresh.....	Boxes.....	--	6,254	--
Single-strength juice	1,000 gal. ¹ ..	109	--	--
Concentrated juice ² ..	...do.....	9	--	(³)
Essential oil.....	Lbs.....	4,946	--	--
Grapefruit:				
Fresh.....	Boxes.....	30,400	192	--
Single-strength juice	1,000 gal. ¹ ..	344	--	--
Concentrated juice ² ..	...do.....	15	--	--
Canned segments.....	1,000 cases ⁴	141	--	--
Essential oil.....	Lbs.....	6,136	--	25

¹ U. S. gallons.

² 60° Brix.

³ Negligible.

⁴ Calculated at 30 lbs. net.

capable of using 1,500 boxes of fruit a day for producing juices.

The operation of this modern plant presents many difficulties, including the scarcity of skilled labor. The plant generally operates for only 6 months a year, and at full capacity for only a part of this time. With such seasonal employment, it is difficult to obtain experienced people each year.

In addition, all cans must be imported and reshaped at the plant. These cans cost US\$.98 for 24 No. 2 cans; the cartons for that size of can cost US\$.15 each.

Storage is a problem, too, since the warm climate causes

TABLE 10.--Exports of indicated grapefruit products from
British Honduras, 1937-54

Year	Single- strength juice	Segments, canned	Concen- trated 60° Brix	Essential oil
	<i>U.S. gallons</i>	<i>Pounds</i>	<i>U.S. gallons</i>	<i>Pounds</i>
1937.....	348	--	--	--
1938.....	10,968	--	--	--
1939.....	--	--	--	--
1940.....	3,527	--	--	--
1941.....	80,061	--	--	--
1942.....	1,892	--	--	--
1943.....	--	--	--	--
1944.....	--	--	--	--
1945.....	--	--	--	--
1946.....	469,628	--	--	--
1947.....	682,814	--	--	--
1948.....	557,335	--	--	--
1949.....	380,903	--	--	--
1950.....	267,049	--	--	--
1951.....	658,740	609,168	--	--
1952.....	523,143	2,404,864	--	--
1953.....	88,920	4,506,400	4,545	4,731
1954.....	344,161	4,225,900	14,991	6,161

Source: British Honduras Department of Agriculture.

rapid decline in quality of the canned juice. A cold-storage plant in Stann Creek has been considered, but there are no immediate plans to begin construction.

British Honduras has the highest cost of production in the British Caribbean territories. In 1954, it cost US\$2.63 per case to produce single-strength orange and grapefruit juice, exclusive of the cost of the fruit. At the same time, Florida was selling cases of 24 No. 2 cans of orange juice for \$2.60 f. o. b. and grapefruit juice at \$1.65 per case. Thus the cost of canning alone in British Honduras was about equal to the sales price of canned orange juice in Florida and nearly \$1.00 per case higher than that of single-strength grapefruit juice.

The average juice analysis for British Honduran oranges and grapefruit in 1954 is provided in table 8. Sugar is added to all the canned citrus juices, as processors claim that the British consumers prefer sweetened juices.

Exports

The United Kingdom takes practically all of British Honduras' processed fruit (table 9). The Citrus Company of Bri-

TABLE 11.--Exports of indicated orange products from British Honduras, 1937-54

Year	Single- strength juice	Concentrated 60° Brix	Essential oil
	<i>U.S. gallons</i>	<i>U.S. gallons</i>	<i>Pounds</i>
1937.....	--	--	--
1938.....	--	--	--
1939.....	--	--	--
1940.....	--	--	--
1941.....	51	--	--
1942.....	--	--	--
1943.....	--	--	--
1944.....	--	--	--
1945.....	--	--	--
1946.....	--	--	--
1947.....	--	--	--
1948.....	3,463	--	--
1949.....	6,694	--	--
1950.....	--	--	--
1951.....	--	--	--
1952.....	--	348	--
1953.....	39,425	690	1,820
1954.....	109,092	8,943.	4,946

Source: British Honduras Department of Agriculture.

tish Honduras, Ltd. packs and ships all citrus products exported to Europe, as it does all fresh fruit. Citrus products are sold at a fixed price to the British grocery trade through an agent in London.

Exports of grapefruit products have been major items in the Colony's foreign trade since 1946, when single-strength grapefruit juice was first exported in volume (table 10). In 1953 and 1954, exports of single-strength grapefruit juice declined and exports of grapefruit sections increased. It is not expected that exports of grapefruit products will change significantly in the future since no change in the level of grapefruit production is expected.

Orange products exports did not reach significant volumes until 1953 (table 11), when the new plantings began to bear in some volume. They are expected to increase rapidly in the next few years as oranges become increasingly available.

The concentrate exported during 1953 and 1954 was mostly for the British squash trade and was of 60° Brix. Most of the future exports will be for the British health program and will be of 65° Brix quality.

PART II: JAMAICA

Jamaica is one of the larger islands in the West Indian group. It contains about 4,400 square miles and, in 1954, had an estimated population of about 1.5 million. Jamaica has been a British colony since 1665, when it was taken from Spain, which had owned it since its discovery by Columbus.

Sugar has always been an important crop in Jamaica. Currently, others of importance are cocoa, bananas, coffee, tomatoes, and citrus. There is a growing interest in pineapple production and some interest in other tropical products. Jamaica's tomatoes find a market in the United States, and more than 75 percent of the bananas used in the United Kingdom are Jamaica-grown. An important nonagricultural source of the island's income is bauxite, which is being mined by several companies.

SUMMARY

Jamaica has been a producer of citrus fruits for over half a century, and in 1955 had an estimated 20,000 acres in citrus. In the past few years the industry has received assistance from the government in the form of loans and grants to growers and subsidies on trees.

Grapefruit has been the primary commercial crop in recent years, especially the Marsh seedless, but few new grapefruit plantings have been made, and future production may be expected to average no more than the 350,000 boxes produced in 1953. Orange plantings, on the other hand, have been expanded since 1949, particularly of the Valencia orange, to supply fruit for the orange juice contract with England, and orange production may increase substantially--from about 650,000 boxes in 1953 to around 2.5 million a year by 1960. Also being produced in increasing quantities are an orange-tangerine hybrid, the ortanique, and a tangelo called the ugli.

Exclusive right to export fresh fruit from Jamaica belongs to the Citrus Growers Association, Ltd., which has about 46,000 members, 45,000 of whom delivered an average of 8 boxes of fruit each in the 1954 season.

Fresh grapefruit exports are made early in the season, from September to December. Most fruit goes to the United Kingdom, where it is sold at auction. The second largest export market is New Zealand, which in 1954 received fruits under a negotiated contract. Of the processed citrus, exports have changed somewhat in recent years: those of pulp have declined and those of grapefruit segments and grapefruit juice have increased. In the past 2 years, only small exports of 65° Brix orange juice concentrate have been made under the British contract; instead, 60° Brix concentrate has been sold to the United Kingdom squash trade at a price higher than could have been obtained under the contract.

Jamaica's oranges and grapefruit tend to be large, and are, of course, of tropical quality, for Jamaica has a tropical

NEG. 833 FOREIGN AGRICULTURAL SERVICE

TABLE 1.--Average temperature and humidity at
Kingston, Jamaica

Month	Humidity		Temperature	
	7 a.m.	3 p.m.	Minimum	Maximum
	<i>Percent</i>	<i>Percent</i>	<i>°F.</i>	<i>°F.</i>
January.....	85	66	62.4	86.9
February.....	83	66	62.6	87.1
March.....	82	66	63.5	89.1
April.....	79	68	65.9	89.4
May.....	78	72	68.3	89.6
June.....	78	70	69.7	90.8
July.....	77	67	69.6	91.2
August.....	80	70	69.9	91.6
September.....	84	73	70.3	89.6
October.....	87	74	69.3	88.8
November.....	88	71	67.5	88.3
December.....	86	67	64.5	86.8
Average.....	82	69	67.0	89.1

Source: Jamaica, Department of Agriculture.

climate. Rainfall in the citrus areas ranges from 55 inches to over 88 inches per year, and most Jamaican citrus is raised without irrigation; the few groves that are irrigated are along the coast near Maypen.

FRESH FRUIT

Cultural Conditions

Climate.--Jamaica has a warm, humid, tropical climate (table 1) which varies greatly throughout the island because of the difference in terrain.

In table 2 the average rainfall by month is given for five representative citrus-producing areas. At Maypen, new irrigated plantings--some of them at elevations as low as 230 feet--usually get less than 2 inches of rain per month from December through February. At Mandeville is one of the highest citrus areas in the island, with most plantings at elevations of about 2,000 feet and with an average annual rainfall of 83 1/2 inches.

In Jamaica, as in any other area with a tropical climate, the blooming season of citrus is controlled by rainfall. The citrus bloom in Jamaica occurs in different areas at different times, but the normal primary blooming season is from February through May, when the heavy rains break the fall drought of December, January, and February.



The citrus district near Bog Walk, Jamaica, with young Valencia trees in the foreground and new plantings on the valley floor.



Beds of seedling oranges at the Department of Agriculture citrus nursery at Bogles. The Department operates five nurseries to produce trees for the citrus expansion program.



Two chief types of citrus culture in Jamaica are the plantation type (left), with a permanent turf of weeds, and the clean cultivation type (right), which has been cultivated by tractor.



To control the fiddler beetle, which feeds on the bark of roots, trees are often planted on mounds in Jamaica, so that the roots can be exposed and watched for infestation.



Psoriasis damage on an old grapefruit tree near Trout Hall, Jamaica. The disease probably exists in sweet orange varieties and may also be in Washington navel and Valencia oranges.

TABLE 2.--Average rainfall in representative Jamaican citrus-producing areas

[In inches]

Month	Alexandria 1,600-ft. el.	Linstead 400-ft. el.	Trout Hall 900-ft. el.	Maypen 230-ft. el.	Mandeville 2,000-ft. el.
January.....	2.65	2.23	1.52	1.45	3.08
February.....	2.38	2.16	1.70	1.80	2.82
March.....	2.22	3.00	3.24	2.45	3.89
April.....	3.88	1.10	4.96	3.14	6.01
May.....	7.14	9.37	9.55	6.36	9.97
June.....	4.09	7.36	5.62	5.28	8.45
July.....	2.76	5.95	4.75	3.26	5.73
August.....	4.78	8.45	8.55	5.35	8.70
September.....	6.17	7.40	10.47	6.72	9.92
October.....	8.20	9.67	12.30	10.20	14.72
November.....	6.41	6.68	8.17	5.02	7.41
December.....	2.98	3.09	2.32	1.87	2.81
Total.....	53.66	66.46	73.15	52.90	83.51

Source: Official data.

Jamaica is in a hurricane region and has experienced an average of one hurricane every 8 years. Some years have been disastrous, such as 1916, with two hurricanes in August and one in October, and 1915, with one in August and another in September. For the most part, the hurricanes have not crossed the island and, when they have, most of them have affected the north coast in the Parishes of Portland, St. Mary, and St. Ann, which are not heavy citrus-producing districts. Since much of the citrus lies on rolling ground protected by hills, it is unlikely that any permanent damage to citrus can be caused by hurricanes.

Cultural Practices. --Because of the varying conditions in the citrus areas, cultural practices in Jamaica differ from area to area.

The most modern groves, planted on rather light soils on level ground in dry areas, are cultivated with tractors in much the same manner as a California orange grove is cultivated. This clean cultivation is practiced only in areas with 50 inches of rainfall per year or less. The groves are also irrigated--now, by surface irrigation, but growers look forward to the time when they can install overhead sprinklers. Abundant water is available but it has to be pumped. In these modern groves, spraying and fertilizing is a general practice. About 8 pounds of sulfate of ammonia per tree are applied each year. The nutrients are put on two to three times during dry periods. Not over 10 percent of the citrus-producing area is in this class, however.

The second type might be called plantation cultivation. Groves in this type are usually planted on rolling land in areas of heavy rainfall, where irrigation is not needed. The groves have a permanent turf of natural weed growth, which is chopped down two to three times a year. This heavy cover provides erosion control, but it also retains moisture and requires the use of drains, which are customarily placed in the middle of every other row. In these groves for at least half of the year the ground is covered with high weeds. Some fertilizing and a little spraying is usually done on these properties.

A third type of cultivation is that of the "big small" grower, who has 100 to 500 citrus trees and cultivates the grove by hand-digging, usually planting annual crops between the trees, such as peanuts, pineapples, sweetpotatoes, beans, and other garden crops. In other small groves the land is not tilled but is mixed-planted to tree crops, such as breadfruit and mangoes, with only small areas utilized for a home garden.

A fourth type of cultural practice is characteristic of the care given most seedling orange groves: Little or no care at all.

Because of these varying cultural practices, the type and quality of the fruit differ widely. Production costs vary, too, but in 1954 the cost of operating a grove was an estimated US\$84 per acre per year.

Pests. --The most severe citrus pest in Jamaica is the fiddler beetle. (See Part I for description.)

Measures of control involve planting trees on mounds and exposing the major framework of the roots, on which the larvae feed. Chemicals are also used. They are applied to the ground to kill the larvae as they drop from the tree. While the chemical control measure seems to be effective, it is still in the experimental stage.

The usual scales are present, including Florida red scale and West Indian scale, but these are usually not serious pests.

Diseases. --The citrus diseases present in Jamaica are about the same as those in the other West Indian areas, with gummosis being the most important disease problem. Very heavy infections of gummosis existed in the old grapefruit orchards visited, and it is reported that the seedling orange trees are gradually dying out from this disease.

Psorosis, or scaly bark, is evident in the older grapefruit groves, too, and probably exists in the sweet orange varieties. And it is likely that the Washington naval and the Valencia oranges now being produced may be infected with the disease.

At present, the new trees being raised are not from scion stock. Many of the groves visited gave evidence of a root disease brought on by excess moisture. Considerable acres of trees were off color or stunted. Tristeza has not been found in Jamaica but it would be a severe problem since most of the trees are raised on sour-orange rootstock.

The Jamaican citrus industry is concerned about a new difficulty, termed "brown stem" or "stem end burn." The fruit is affected by the peel's turning brown around the stem, and, when gas is used or color is added, the brown spreads. The cause of the disorder is not as yet known, but it is believed to be in some way related to cultural practices.

Varieties. --Jamaica is changing the varieties of citrus it produces. The most important orange variety in 1955 was still the seeded orange, which grows wild in parts of the island; but it will shortly be succeeded by the Valencia orange, as the new acreages come into production. The most important grapefruit variety is the Marsh seedless; however, some Duncan is produced, as is a sweet seeded grapefruit, which has been unsuccessfully used for grapefruit segments. The West Indian lime is an important commercial variety utilized primarily for processing. The ortanique, an orange-tangerine hybrid, is a variety of growing importance, and, since it is similar to a tangerine in quality but has better shipping characteristics, it is possible to use this type in the export trade. Shipments of the ortanique to England have been well received, and have brought as high as US \$6.16 per box. While the ortanique is primarily a table fruit, it has also been utilized for the manufacture of canned orange juice. It cannot be used for Ministry of Food concentrate, however, because of its low vitamin C content. Despite its not having the protection of the Ministry of Food contract, the ortanique is favored by citrus growers because it is a high producer--in Jamaica, about twice as high as the average orange tree.

TABLE 3.--Juice tests of selected citrus fruit, Jamaica, 1954

Item	Ortanique (end of season)	Oranges		Grapefruit, Marsh seedless (average)
		Seedlings (average)	Valencias (average)	
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Solids.....	6.2	4.50	5.3	3.80
Juice.....	48.0	45.4	53.0	40.0
Brix.....	12.8	9.9	10.0	9.7

Source: Jamaica Citrus Growers Association, Ltd.

TABLE 4.--Estimated total production of sweet oranges and seedless grapefruit in Jamaica, 1949-50 through 1953-54

[In thousands of boxes]

Season	Sweet oranges	Grapefruit (Marsh & Duncan)
1949-50.....	800	400
1950-51.....	725	350
1951-52.....	600	250
1952-53.....	775	340
1953-54.....	650	350

Source: Citrus Growers Association and estimates by writer.

The ugli is a citrus variety peculiar to Jamaica, and is said to be a grapefruit-tangerine hybrid--a tangelo. When mature, the fruit has a yellow peel, and its flesh is like that of an orange. The fruit is juicy and can be eaten in the hand. The ugli has been utilized in processing and its juice has been sold as "tangelo" juice.

Some characteristics of Jamaican citrus varieties can be illustrated by juice tests (table 3). The figures for oranges and grapefruit given in the table are averages, and may be considered typical of midseason characteristics. The figures for ortanique juice are not comparable with those for the other types, since the test was made at the end of the season and is representative of full maturity.

Government Nurseries. --The Department of Agriculture operates five nurseries in Jamaica to produce trees for the

citrus expansion program. These trees are produced at an average estimated cost of about US \$.28 per tree, and are sold to growers at a price of US \$.14. Under certain circumstances, trees are given free as a part of the hurricane rehabilitation program.

About 80 percent of the trees produced have been budded to the Valencia variety. Most have been raised on sour-orange rootstock, which is preferred by most planters. A few have been raised on sweet-orange rootstock, and some on "Hog Shaddock," which is a vigorous rootstock in Jamaica on certain heavy red soils.

Since 1951 the government nurseries have distributed the following number of trees:

<u>Year</u>	<u>Trees</u>
1951	66,871
1952	93,809
1953	129,998
1954	173,001

During this time the Department of Agriculture produced about half of the new trees; growers raised the rest for their own use. In all about 1 million trees were produced in this period--enough for the entire citrus expansion program as it was originally planned.

In June 1955 the Department of Agriculture had available at least 600,000 seedlings ready to be planted into nurseries for propagation. Citrus rootstock is, therefore, available for any continued expansion of plantings that may be undertaken. To maintain the industry at its present size, some 50,000 trees a year would be required; for the small grower generally loses about 10 percent of the trees he plants.

Production

There are no official data on citrus production. A large part of the fruit from small groves, particularly in remote areas, is utilized for domestic consumption or sold locally and cannot be recorded. The citrus that enters into commercial trade is handled by the citrus association, sole agent for the export of fresh fruit, which has data on that part of the production.

Estimates of the total sweet orange and seedless grapefruit production for 1949 through 1953 seasons are provided in table 4, utilizing the citrus association production data as a basis and adding approximately 250,000 boxes of oranges and 50,000 boxes of grapefruit per year.

In addition to these oranges and grapefruit, Jamaica now annually produces an estimated 150,000 boxes of sweet seeded grapefruit, 50,000 boxes of bitter oranges, and about 12,000 boxes of ortaniques. The ortaniques are utilized in commercial trade as a fresh fruit and in the processing plants as a source of juice. Bitter oranges are harvested and exported--mostly in the form of marmalade--in accordance with demand.

The sweet seeded grapefruit has been found to be unsatisfactory for the manufacture of grapefruit segments and is utilized only in the domestic market.

In the future, Jamaican orange production will increase rapidly as young Valencia orchards come into bearing; a production of 2.5 million boxes is possible by 1960. Output of the most important grapefruit varieties--the seedless Marsh and Duncan--will probably be maintained at a level of about 350,000 boxes per year. The production of sweet seeded grapefruit will probably decline, and that of the orange-tangerine hybrid, ortanique, will probably increase, since this variety gives a much higher yield of fruit than the Valencia orange. While its juice is not suitable for concentrate, it can be used for single-strength orange juice.

Jamaica has a very complex citrus industry. Not only do types of culture differ, but the size of the producing units varies widely, especially units producing oranges.

In 1955, over half of the production of sweet oranges came from groves that produced from 1 to 50 boxes each. For example, 336,000 boxes of sweet oranges were supplied by over 45,000 grower members of the citrus association. Thus, the association received an average of about 8 boxes of oranges from each grower. These were primarily seedling oranges. Only about one-eighth of the oranges came from groves that produced over 5,000 boxes.

The pattern of grapefruit production is different in that this fruit is planted mostly in large groves. In 1955, about half of the grapefruit came from groves that produced over 5,000 boxes of fruit.

The small citrus grower will continue to be a factor in the future, for a great many of the new plantings are still being made by the grower who may have 100 trees or less. The many small growers are a complicating factor in the industry. (In 1954 the association listed over 46,000 member growers.) They have little incentive to improve the quality of their fruit, for the association receives fruit by the truckload of about 200 boxes and grades it according to this unit. A grower who has, say, 50 boxes of excellent-quality fruit that is loaded on the same truck with the poor-quality fruit of his neighbor will not be rewarded for his efforts because his shipment will be graded in accordance with the whole truckload. It is only those growers who have enough fruit to deliver in whole truckloads that may receive credit for the grade of fruit delivered.

Districts. --Citrus is widely planted in Jamaica. But most of the older plantings of grapefruit are in the Parishes of Clarendon and St. Catherine; over half of the recent plantings of oranges are there, too, as the following figures on plantings during 1947-54 show:

<u>Parish</u>	<u>Acres</u>	<u>Parish</u>	<u>Acres</u>
Clarendon.....	1,998	St. Elizabeth	163
Hanover	74	St. James.....	596

(Continued on next page)

Manchester	604	St. Mary	527
Portland	120	St. Thomas	114
St. Andrew	164	Trelawny	103
St. Ann	413	Westmoreland	224
St. Catherine	1,776	Total	6,880

Source: Citrus Growers Association, Ltd.

Also in the Parishes of Clarendon and St. Catherine are the two major fresh-fruit packinghouses and processing plants.

Acreage. --There are no official data on Jamaica's citrus acreage. Owing to the difficulty of determining acreages in mixed and wild plantings, only rough estimates are possible; but accurate figures are available on recent plantings, which are the most important since they will be the source of most fruit moving in foreign trade in the future.

From 1947 through 1954, nearly 13,000 acres were planted under the new expansion program. An additional 2,000 acres are to be planted in 1955, making the total of the new acreage at the end of that year about 15,000 acres--mostly in Valencia oranges, but some in ortanique and a little in grapefruit. Of the citrus trees more than 7 years of age, most are grapefruit and wild oranges. The acreage they cover is estimated at roughly 5,000 acres. Therefore the total planted citrus acreage in Jamaica at the end of 1955 is estimated at slightly less than 20,000 acres:

<u>Year of planting</u>	<u>Acres</u>
1947	396
1948	412
1949	450
1950	940
1951	2,627
1952	2,054
1953	3,237
1954	2,833
Total	12,949
1955 ¹	2,000
Before 1947	5,000
	19,949

¹Estimated.

Source: Citrus Growers Association, Ltd.

New Plantings. --The planting of citrus is continuing in Jamaica, and at least 300,000 trees could be budded in 1956. These new plantings are in addition to the original expansion program of 1 million trees, which was completed at the end of 1954.

Several factors are stimulating the interest in citrus.

Citrus can be produced in many areas in Jamaica, mostly

without irrigation. It is a suitable crop for both the small and the large grower. The new varieties being introduced will extend the season for both domestic consumption and the export and processing trade.

The restrictions being placed on the production of sugar contribute to the interest in citrus. Some of the acreage that will be taken out of sugar will be utilized for bananas, and some will be planted to citrus.

Also, some plantings are in response to the waiver obtained by the United Kingdom recently under the General Agreement on Tariffs and Trade to permit the protection of colonial interests. A part of the citrus industry interprets this as a mandate to further expand citrus production for the English market. One can only speculate as to how much additional acreage will be planted. In May of 1955, plantings were continuing. Trees and land are available for several years' planting. Some trade sources indicate that plantings will continue until the acreage is about double the size it was in 1954.

Labor Requirements. --The amount of labor needed to care for a citrus planting in Jamaica depends, of course, upon the type of cultivation used.

The tractor-cultivated groves, according to trade reports, utilized about six men on a year-round basis for 80 acres. Additional labor is employed in such groves for seasonal work.

In the groves that have a permanent turf of weeds, the weeds have to be cut two to three times a year, the vines have to be pulled out of the trees, and the plant parasites have to be removed. General work on this kind of planting requires one man to 6-8 acres, according to estimates. The general work force is supplemented seasonally for weed cleaning, drain repairs, and fruit harvesting.

To estimate the approximate labor load in the Jamaican citrus industry, we will consider that the mechanically tilled groves use about 1 man to every 14 acres and the hand-tilled groves, 1 man to about 5 or 6 acres. As an average figure, if we consider that in the total industry a permanent labor load is about 1 man to every 8 acres, it will then require about 2,500 permanent employees to cultivate Jamaica's 20,000 acres. This is a fair estimate, inasmuch as some of the citrus groves are pastured and some citrus is in mixed groves requiring little or no cultivation or is in mixed cultivation where it is cared for along with other crops. If we consider that 1,000 additional seasonal workers are utilized in cultivation and harvest tasks and that 1,000 persons are employed each year in the citrus processing and packing plants, the total commercial labor load in the citrus industry may be estimated at about 4,500 persons. In the future, this labor load might be increased somewhat as the many young groves come into production.

As a further evaluation of the number of people who are engaged in Jamaica's commercial citrus industry, we will consider that a commercial employer or a commercial grower

must earn at least US\$50 per year in the citrus industry. If we apply this rule, we must certainly eliminate most of the 45,000 citrus association growers who in 1954 delivered only an average of 8 boxes of fruit each. Certainly, over 90 per cent of Jamaica's commercial citrus production comes from not more than 500 citrus growers.

It is thus evident that, while there are a great number of people in Jamaica who may have a citrus tree and sell some fruit, the number of persons who are engaged in the commercial citrus industry, either as employees or as growers, does not at the present time exceed 5,000. The citrus industry, therefore, is not commercially important to a large number of people.

Costs. --The cost of producing citrus in Jamaica is given in great detail in the report of the Fact-Finding Mission,¹ which estimates the average cost of maintaining a citrus grove at about US\$84 per acre per year. It states further that, considering that yields of 200 boxes per acre for oranges and 300 boxes per acre for grapefruit may be obtained, the cost of production per box is about US\$.49 for oranges and US\$.35 for grapefruit.

The yields given are at least double those obtained in the recent past and certainly if attained will apply only to the best operated groves. It is the opinion of the writer that yields of half this amount might be more realistic in the long run, in which case the above-mentioned cost per box would be about double. The cash cost of operation of US\$84 per acre applies to the large plantation citrus orchard. Since over half of even the new acreage planted is in small groves, the cost in these operations will be much less. This is true because the small grove is a mixed culture, and all cost of cultivation has to be divided between the several annual and tree crops which may be raised together with citrus. For the most part this applies to orange production, since most grapefruit is produced in plantation groves.

If it is considered that cost of production for plantation groves might be higher than indicated and that it will be lower for small groves, the average cost of production would still appear to be very reasonable and should not exceed US\$.56 per box for oranges and about US\$.42 per box for grapefruit.

Permanent on-the-farm employees are supplied with housing, garden, wood, and so forth, in addition to cash wages. The detailed wage rates for 1955 given in the tabulation below apply only to casual labor probably employed on a seasonal basis and the rough average wage for this type of labor is about US\$1 per day. Taxes are generally moderate, but vary widely since the rate is based on the valuation at the time of purchase. Some growers report that taxes are as much as \$5 per acre per year.

¹"The West Indian Citrus Industry," Report of Fact-Finding Mission, Colonial No. 314, Feb. 25, 1955.

<u>Item</u>	<u>Unit</u>	<u>Cost</u> (US dollars)
Wages:		
Ordinary labor	Weekly	\$4.20 - \$7.00
	Daily	.98 - 1.26
Piece rates:		
Preparing planting mounds	100 ft.	7.00
Cutting weeds to the drip:		
Small trees	100	1.75
Large trees	Each	.05
Taxes	Acre	.07 - .70

Source: From the trade.

It is likely that in the immediate future the cash cost of operation of citrus properties in Jamaica will remain reasonable by comparison with cultural cost in the United States.

Consumption and Marketing

Domestic Consumption. --Only a very rough estimate can be made of consumption of citrus in Jamaica, but a great deal of the fruit is consumed in the country. For instance, an estimated one-third of the orange crop of 1953 was used domestically. Production of that crop, which was harvested mostly in 1954, was about 650,000 boxes; about 49,000 boxes were exported as fresh fruit, around 100,000 were utilized to make

TABLE 5.--Sample pack-out, by size, of Jamaican citrus fruit, 1954

[In boxes]

Size	Valencia oranges	Ortanique	Size	Marsh seedless grapefruit
112.....	--	129	70.....	210
126.....	351	550	80.....	62
150.....	649	416	96.....	134
176.....	641	344	112.....	61
200.....	502	156	126.....	18
226.....	323	63	150.....	1
250.....	55	5		
288.....	32	--		
Total.....	2,554	1,663	Total...	476

Source: Citrus Growers Association, Ltd.

TABLE 6.--Some of the costs of harvesting and marketing fresh citrus, Jamaica, 1955

Item	Unit	Cost (equivalent in U. S. dollars)
Day labor:		
Men.....	Hour.....	\$0.18
Women.....	...do.....	.14
Packing (piece rates):		
Oranges.....	Box.....	.07
Grapefruit.....	...do.....	.15
Two-compartment wire-bound box.....	Each.....	.53
Picking.....	Box.....	.07 - \$0.11
Transport of fruit from grove to packing- house.....	Box.....	.22 - .23
Freight to U.K.:		
Ventilated stowage....	...do.....	1.12
Refrigerated stowage..	...do.....	1.30

Source: Trade information.

single-strength juice, and about 250,000 went into the production of commercial orange juice concentrate. This leaves an estimated domestic consumption of about 250,000 boxes, or about 11 pounds of oranges per capita. Jamaica is different from other West Indian citrus areas in that it consumes more grapefruit. The estimated annual production of about 150,000 boxes of sweet seeded grapefruit is consumed entirely in the domestic market, and at least 15,000 of the 350,000 boxes of Marsh and Duncan grapefruit produced are also consumed locally. This rate of consumption is about 7 pounds per capita per year.

Size of Fruit. --All citrus fruit produced in Jamaica tend toward large sizes. The example given in table 5 does not include all sizes; the very small and the very large fruits have been eliminated from the selection. But over half of the 2,500 boxes of Valencia oranges are size 176 and larger, over half of the 476 boxes of grapefruit are size 80 and larger, and over half of the 1,600 boxes of ortaniques in this sample are size 150 and larger. Size plays an important part in the suitability of Jamaican fruit for European markets. Only about one-third of the oranges and grapefruit are small enough for the export trade.

Marketing Costs. --Cost for day labor in the Jamaican citrus industry is exceedingly low, ranging from US\$.14 to US\$.18 an hour, and the cost of packing is also very reasonable--about US\$.15 per box for grapefruit and US\$.07 per box for oranges (table 6). The cost of transporting fruit from grove to packinghouse, on the other hand, is relatively high. And the freight rates effective in 1955--US\$1.12 per box for ventilated stowage and US\$1.30 per box for refrigerated stowage--are much higher than comparable rates from either the Mediterranean or South African areas.

Early in the season, fresh grapefruit from Jamaica is competitive with fruit from other areas. For example, at a fruit auction in London on December 1, 1954, size 96 grapefruit from Israel averaged US\$4.90 per box, from Cyprus US\$4.48 per box, and from Jamaica US\$5.32 per box (table 7). The price advantage is even greater by the pound, since the Jamaican box is at least 15 pounds lighter than the container used by Cyprus and Israel.

Exports. --Jamaica has exported fresh citrus for at least 70 years. In the 1880's, large quantities of seedling oranges packed in barrels were shipped to the United States. Before World War II, oranges were still the most important export item; in 1938 over 300,000 boxes were exported. In the post-war period, orange exports have been small and the grapefruit exports have been about the same as prior to 1940 (table 8). In 1950, Jamaica exported a quarter of a million boxes of oranges. But that fall a hurricane damaged the groves, and since then the average volume has been around 50,000 boxes. The grapefruit story has been much the same. The 183,000 boxes exported in 1950 were reduced to 92,000 in 1951 and only 47,000 in 1954.

TABLE 7.--Average prices received for Marsh seedless grapefruit from Israel, Cyprus, and Jamaica in a London fruit auction on December 1, 1954

[Equivalent in U. S. dollars per box] ¹

Size	Israel	Cyprus	Jamaica
64.....	\$5.04	\$4.48	\$5.04
70.....	--	--	4.83
80.....	4.97	4.48	5.32
96.....	4.90	4.62	5.46
112.....	4.69	4.62	5.25
126.....	4.48	--	--
128.....	---	4.41	--

¹ 75-lb. box from Jamaica; 90-lb. box from Israel and Cyprus.

Source: Price catalogs of auction members.

TABLE 8.--Exports of fresh oranges and grapefruit from
Jamaica, 1937-54

[In thousands of boxes]

Year	Oranges	Grapefruit ¹
1937.....	239	151
1938.....	327	163
1939.....	318	203
1940.....	269	52
1941.....	85	14
1942.....	10	5
1943.....	(²)	(²)
1944.....	11	5
1945.....	22	5
1946.....	83	36
1947.....	80	78
1948.....	119	135
1949.....	219	201
1950.....	224	183
1951.....	55	92
1952.....	48	71
1953.....	88	64
1954.....	49	47

¹ Boxes of 85 fruits, the standard conversion factor used in Jamaica.

² Negligible.

Source: Jamaica, Central Bureau of Statistics.

Jamaica's citrus fruits mature early. Most exports of grapefruit take place between September and December, a favorable marketing time for grapefruit. It is the one period when good grapefruit is in very short supply in Western Europe, for it is too early for Mediterranean fruit and late in the season for South African.

The pattern of fresh orange exports is somewhat different; seedling oranges are exported in December and Valencias in March. As more Valencias, a variety highly suited to export, come into production, larger shipments after the first of the year may be anticipated.

The primary citrus marketing factor in Jamaica is the Citrus Growers Association, established in 1944. It is now the authority designated to implement the legislation passed as the Citrus Fruit Marketing Plan of 1929. This designation gives the association the right to be the sole controller of all fresh citrus exports from Jamaica. The legislation does not cover domestic marketing, which is carried on without government supervision; nor does it apply to processed products.

The fruit exported to the British market has been consigned, while that shipped to New Zealand has been sold under a negotiated contract. In the 1954-55 season the contract f.o.b. prices for oranges sold to New Zealand varied with the season: from November 1 to December 15, US\$3.92 per box f.o.b. Jamaica; December 16 to February 13, US\$4.20 per box; and after February 13, US\$4.48 per box. The f.o.b. price of grapefruit was US\$3.36 per box. The returns to growers from fresh fruit sales in recent years have been satisfactory.

PROCESSED FRUIT

Production

The largest citrus processing plant in Jamaica is owned by a private company and located at Maypen, about 35 miles west of Kingston. It packs fresh fruit and manufactures a wide variety of products. The plant has a capacity of about 10,000 boxes per day, at which rate it would utilize about 1,500 boxes in fresh fruit packing and 8,500 boxes in processing. The capacity may be expanded in the future by the installation of equipment to manufacture concentrated frozen orange juice for the British market.

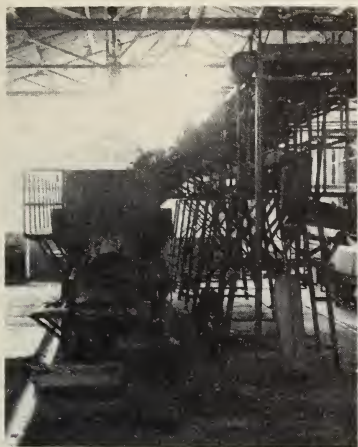
The plant is equipped for complete citrus processing; it produces essential oil of grapefruit, orange, lemon, and lime; single-strength orange and grapefruit juices; both 60° and 65° Brix orange and grapefruit concentrates; citrus pulp; marmalade; and grapefruit segments.

The yield of essential oil is said to be high; that for oranges, for example, ranges from 4 to 7 ounces of raw oil per 100 pounds.

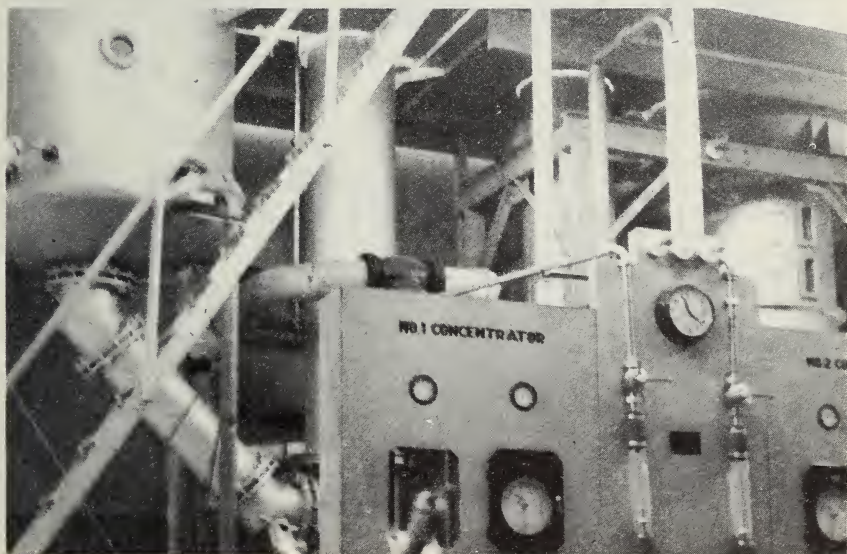
The single-strength juice, although of good quality, must be stored cold; for, like all juices in Jamaica, it deteriorates in the island's warm climate. Cold-storage facilities are available in Kingston, however.

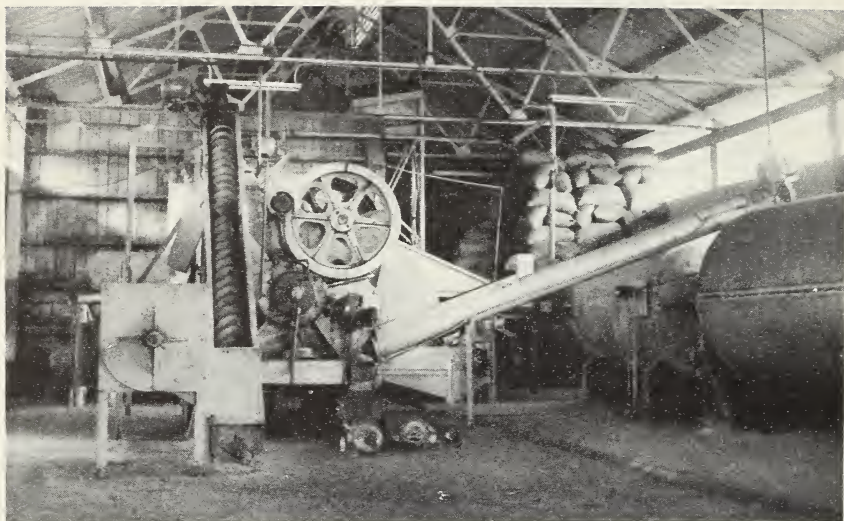
The orange juice concentrate that is produced for the British Ministry of Food is a 65° Brix product and is packed in cans. It is said to have ascorbic acid content that averages from 329 to 360 milligrams per 100 grams of concentrate. The orange and grapefruit concentrate produced for the English squash trade is a 60° Brix product and is packed in casks and preserved with SO₂. Before it is juiced, all of the fruit is de-oiled. For de-oiling, two Italian batch machines are used; each has a capacity of only 30 boxes per hour. In addition, two continuous machines have been installed, one of Israeli and one of American manufacture.

Many difficulties attend citrus processing in Jamaica. One of them is the short season; fruit is available in volume from November to February only. This will be corrected when the large plantings of Valencia oranges come into bearing and extend the processing season to June. Another difficulty is shortage of electric power; the cans have to be shaped and completed at the plant, and it is reported that electric power

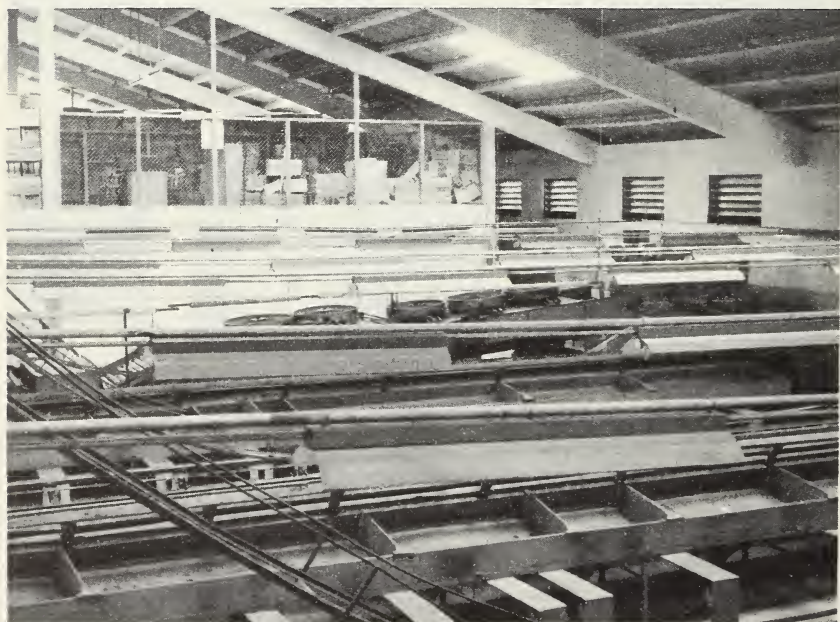


Some of the equipment in Jamaica's largest citrus-processing plant, at Maypen, is pictured here. Left, the juice extractor; bottom left, the concentrator; bottom right, grapefruit segments canning facilities.





Jamaica has a large citrus-processing plant at Bog Walk. That plant's peel dehydrator is shown above and its fresh-fruit packing equipment, below.



is not always available in adequate supply, necessitating the use of auxiliary electric generating capacity. Still another difficulty is the high cost of the materials used in making canned juices; a cardboard carton costs US\$. 14, and 24 No. 2 cans made up at the plant cost about US\$1.02. The 24 labels for a case of juice cost US\$.07. The total direct cost of materials for a case of juice or sections is the equivalent of about US\$1.22.

The second largest citrus processing plant in Jamaica is located at Bog Walk and is operated by the Citrus Growers Association. This plant also packs fresh fruit and manufactures products. Its capacity permits packing 2,000 boxes of fresh fruit per day and processing 150 boxes of fruit per hour. At present, because of the short processing season, the plant operates fully between October and February only; but attempts are being made to utilize it during the summer season for the canning of pineapple. During the processing season the plant is operated 24 hours per day, and the fruit is purchased from the citrus association, which deals directly with the growers.

The plant is equipped with modern machinery and is capable of producing single-strength juices, 60° and 65° Brix concentrates, dehydrated citrus peels, and essential oils. As now equipped, the plant has only one production line, but plans call for a second one so that both orange and grapefruit juices can be processed at the same time. The plant contains a de-oiler, a juice extractor, and two concentrates--all of Israeli manufacture. A modern laboratory is maintained for research and quality control.

Marketing

Ministry of Food Contract. --In order to obtain supplies of orange juice concentrate from a sterling area, the British Ministry of Food in 1950 entered into a 10-year contract with Jamaica and British Honduras under which they were to supply the United Kingdom with up to 5,000 tons of 65° Brix orange juice concentrate per year. The concentrate was to be purchased at a price that began at the equivalent of \$5.04 per U.S. gallon f.o.b. the West Indies and was to be gradually reduced to \$3.70 per U.S. gallon by the 1954-55 season. To fulfill this contract, Jamaica and British Honduras started 10-year citrus planting programs to produce approximately 2,500,000 boxes of oranges, which will be required to supply the maximum amount of juice. In addition, two concentrate plants were built in Jamaica and one in British Honduras.

Under the Ministry contract, processors are required to furnish 75 percent of production. However, with the slow growth of West Indian orange production, the small volume of concentrates available, and the opportunity for West Indian processors to sell concentrates to the United Kingdom squash industry at higher prices than to the Ministry of Food, waivers to the contract were requested during the last two seasons,

TABLE 9.--Exports of concentrated orange juice from Jamaica to the United Kingdom Ministry of Food, and total exports, 1949-50 to 1954-55

[In thousands of U. S. gallons]

Season	Deliveries to Ministry of Food ¹	Total exports ²
1949-50.....	65	310
1950-51.....	79	233
1951-52.....	82	232
1952-53.....	111	252
1953-54.....	8	153
1954-55.....	31	192

¹ 65° Brix only.

² 60° and 65° Brix combined.

Source: Deliveries to Ministry of Food, "The West Indian Citrus Industry," Report of Fact-Finding Mission, Colonial No. 314, p. 25; total, Jamaica, Central Bureau of Statistics.

permitting the West Indies to furnish the Ministry of Food with only token quantities of concentrates. In the 1954-55 season, only about one-sixth of the concentrate produced was sold to the Ministry (table 9).

Jamaican processors express the opinion that, as a result of the Fact-Finding Mission report, a higher price will be granted in the contract for concentrates and that next season (1955-56) greater quantities of juice will be furnished the Ministry. The failure of processors to deliver concentrate has been one factor contributing to United Kingdom purchases of orange juice concentrate from the United States.

Prices. --The price at which concentrate is sold to the Ministry of Food--US\$3.99 per imperial gallon, f. o. b. Kingston in May 1955--is considered too low to give the grower a fair return for his fruit. (Usually it is necessary to store the Ministry of Food concentrates for about 2 months before shipment, at a cost of US\$.21 per case; the charges are paid by the citrus association and therefore are deducted from grower returns.) By comparison, the 6-to-1 concentrate manufactured for the squash trade was sold at US\$4.13 per gallon in May 1955, and this price, owing to the lower concentration, has resulted in satisfactory returns to the grower.

Exports. --Single-strength orange, grapefruit, and lemon juices have been produced since the new citrus processing plants were installed in 1945. The export of single-strength orange juice has declined since 1948, while grapefruit juice exports have increased, reaching over 1 million U.S. gallons in 1954 (table 10). In recent years, lime juice exports have also shown a steady increase.

However, in Jamaican trade data, single-strength juice is sometimes referred to as canned, and concentrated juice is sometimes referred to as in casks. It is, therefore, possible that some of the exports termed single-strength juices may be canned concentrate and in a similar manner some of the juice reported as concentrated may be single-strength juice in casks.

Orange and grapefruit juice concentrates have been manufactured and exported since before the war, but only since the war has the juice been pasteurized. In the future the exports of orange juice concentrate are expected to increase greatly as the industry begins to supply more of this product on the British contract.

Jamaica also exports canned grapefruit and orange segments and citrus pulp and peel (table 11). Citrus pulp was an important export item during the war years, with exports totaling over 18,000 short tons in 1942. This item declined to slightly under 300 tons in 1954. Immediately after the war, there was a large export of citrus peel, which reached nearly 4 million pounds in 1949. Exports of this item also have been

TABLE 10.--Exports of single-strength and concentrated citrus juices from Jamaica, 1938-54

[In thousands of U. S. gallons]

Year	Single strength				Concentrated	
	Orange	Grapefruit	Lemon	Lime	Orange	Grapefruit
1938.....	--	--	--	24	106	87
1939.....	--	--	--	21	35	26
1940.....	--	--	--	10	133	86
1941.....	--	--	--	7	142	285
1942.....	--	--	--	3	106	87
1943.....	--	--	--	(¹)	6	16
1944.....	--	--	--	53	94	49
1945.....	--	199	10	4	244	112
1946.....	285	344	24	157	44	30
1947.....	56	1	15	2	34	120
1948.....	545	186	25	3	123	43
1949.....	286	188	10	--	310	94
1950.....	396	281	12	5	233	89
1951.....	136	329	2	3	232	428
1952.....	10	320	11	55	252	93
1953.....	259	563	145	100	153	187
1954.....	203	1,109	5	129	192	86

¹ Less than 1,000 gallons.

Source: Jamaica, Central Bureau of Statistics.

TABLE 11.--Exports of specified citrus products
from Jamaica, 1938-54

Year	Grapefruit segments	Orange segments	Citrus pulp	Citrus peel
	1,000 cases equiv. 24 No. 2's ¹	1,000 cases equiv. 24 No. 2's ¹	Short tons	1,000 pounds
1938.....	--	--	--	(2)
1939.....	--	--	--	(2)
1940.....	--	--	--	(2)
1941.....	--	--	--	--
1942.....	--	--	18,345	--
1943.....	--	--	17,813	--
1944.....	--	--	14,277	--
1945.....	--	--	5,332	8
1946.....	--	--	7,907	94
1947.....	--	--	4,285	585
1948.....	--	--	9,988	2,447
1949.....	(3)	--	3,511	3,816
1950.....	(3)	5	645	796
1951.....	57	51	167	857
1952.....	150	(3)	400	756
1953.....	115	--	193	295
1954.....	186	1	296	182

¹ Converted at 30 lbs. net.

² Quantities not reported.

³ Negligible.

Source: Jamaica, Central Bureau of Statistics.

declining as increased supplies have become available from the Mediterranean, and only 182,000 pounds were exported in 1954.

Both grapefruit and orange segments are new items of production, the first exports occurring in 1949. With the exception of 1951, all of the exports of orange segments have been small. The total exports of grapefruit segments have shown a steady increase and over 185,000 cases (5.5 million pounds) were shipped in 1954.

Of the exports of the essential oils of grapefruit, orange, lemon, and lime, the most important are orange and lime oils, both of which have been consistently important since 1940 (table 12).

Most of Jamaica's citrus and citrus products are sold to the United Kingdom or other members of the sterling area (table 13). New Zealand was the most important market for fresh oranges, taking practically all of the 49,000 boxes exported. The United Kingdom purchased about two-thirds of the grape-

fruit exports, the remainder being shipped to New Zealand. About 13,000 boxes of other citrus fruits, primarily ortaniques, were exported to New Zealand.

Canada was the largest purchaser of citrus pulp; and the United Kingdom purchased nearly all of the lime juice exports, probably for utilization in the squash trade. It also took most of the orange and grapefruit concentrated juices, the single-strength orange and grapefruit juices, the grapefruit segments, and the essential oils.

TABLE 12.--Exports of citrus oils (mostly raw)
from Jamaica, 1938-54

[In thousands of pounds]

Year	Grapefruit	Orange	Lemon	Lime
1938.....	--	5	--	1
1939.....	--	51	--	17
1940.....	--	61	--	8
1941.....	--	70	--	11
1942.....	--	105	--	13
1943.....	4	2	--	14
1944.....	(¹)	53	--	29
1945.....	--	31	1	22
1946.....	--	52	1	22
1947.....	1	56	--	12
1948.....	--	24	--	28
1949.....	--	78	--	52
1950.....	1	89	1	45
1951.....	4	85	--	49
1952.....	3	109	1	20
1953.....	7	103	1	44
1954.....	5	144	1	32

¹ Less than 1,000 pounds.

Source: Jamaica, Central Bureau of Statistics.

Jamaica has recognized that the quality of processed citrus products must be satisfactory for the British consumer and that high standards must be adhered to. In 1950, 1951, and 1952 the British grocery trade reported a lack of uniformity in the quality of Jamaican citrus products. To create standards of export quality for all citrus products from the West Indies, a Standard Legislation Committee was established in 1954. It has completed its survey, and the standards, while not yet established, in the future should aid Jamaica and other British West Indian territories to improve the quality of export citrus products.

TABLE 13.--Exports of certain fresh and processed citrus products from Jamaica,
by principal country of destination, 1954

Product	United Kingdom	New Zealand	Canada	Others	Total
Fresh fruit:					
Oranges.....1,000 boxes...	--	49	--	(¹)	49
Grapefruit.....do..	30	17	--	(¹)	47
Other.....do..	4	13	--	1	18
Single-strength juices:					
Orange.....1,000 US gal.	197	6	--	--	203
Grapefruit.....do..	1,101	8	--	(¹)	1,109
Lime.....do..	125	--	--	4	129
Concentrated juices:					
Orange.....do..	192	--	--	(¹)	192
Grapefruit.....do..	86	--	--	(¹)	86
Essential oils:					
Orange.....1,000 lbs....	111	--	--	33	144
Lime.....do..	28	--	--	4	32
Other products:					
Grapefruit segments.....1,000 cases ² .	185	--	--	1	186
Citrus pulp.....short tons...	37	--	259	--	296

¹ Negligible.

² Equivalent to 24 No. 2's.

Source: Jamaica, Central Bureau of Statistics.

PART III. TRINIDAD

Trinidad is a small, heavily forested island about 32 miles wide and 50 miles long. Discovered in 1498 by Columbus, it has been a British possession since 1797. The population is about 650,000 at present and is rapidly increasing.

Petroleum is Trinidad's largest industry and is primarily responsible for its economic well-being. The island is also a transshipping point for bauxite mined in Surinam and British Guiana. The ore is stocked in Trinidad and shipped to the United States.

The primary agricultural export is sugar. Other important agricultural crops are cocoa, coffee, coconuts, rice, bananas, and citrus fruits.

SUMMARY

In 1955 Trinidad's citrus area totaled about 17,000 acres --9,000 acres of grapefruit and 8,000 acres of oranges. Yearly average production of grapefruit is expected to remain about the same as at present--some 660,000 boxes--but orange production may increase from the present 275,000 boxes to about half a million boxes by 1960. Though West Indian limes have been one of Trinidad's primary commercial crops in the past, lime plantings have been severely damaged by disease and production has sharply decreased. The yields of oranges and grapefruit are low, averaging about one box per tree. Principal commercial varieties are Valencia oranges and Marsh seedless grapefruit.

In Trinidad's tropical climate, where rainfall averages from 60 inches to 100 inches a year, citrus trees grow rapidly and have a short commercial life. All groves must have extensive drainage systems. Most plantings are located near the rain forests. A turf culture is used; but most of the season the groves contain a weed growth 4 to 5 feet high.

The most prevalent citrus disease is gummosis, but outbreaks of psorosis were also observed. Citrus scab and melanose are present. Pests include scales, thrips, leaf-cutting ants, and plant parasites. Very little spraying is done because of rainfall and cultural conditions.

The citrus fruits produced are of tropical quality. The grapefruit, however, is of the small size most acceptable to European markets, and competes fairly well with Mediterranean grapefruit in the English market the first 4 months of the year. Most grapefruit exports are shipped to the United Kingdom; most orange exports go to the Caribbean, an important part of Trinidad's foreign market. In 1954 more than 45,000 boxes of oranges, as well as about 146,000 gallons of citrus juices, were exported to West Indian customers. Domestic consumption is estimated at about 20 percent to 30 percent of the orange production and 2 percent of the grapefruit production.

Trinidad's sole processing plant produces only single-

strength orange and grapefruit juices and blended orange-grapefruit juice. In 1954 about 900,000 gallons of grapefruit juice, 200,000 gallons of orange juice, and 30,000 gallons of blend were exported, primarily to the United Kingdom but also to Canada, New Zealand, and Western Germany. Exports of citrus juice to Canada declined from about 1,128,000 gallons in 1953 to only 73,000 in 1954 because Trinidad could not meet Florida's competitive prices in that market.

TABLE 1.--Climatic data as recorded at St. Clair Experiment Station, Trinidad

Month	Average rainfall ¹	Average temperature ¹		Average humidity ²
		Maximum	Minimum	
	<i>Inches</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
January.....	2.70	86.4	68.2	77.3
February.....	1.48	86.5	67.6	77.1
March.....	1.80	87.2	67.9	77.6
April.....	1.86	88.8	69.3	79.1
May.....	3.46	89.8	70.5	80.2
June.....	7.65	87.4	71.0	79.2
July.....	8.74	87.4	71.0	79.2
August.....	9.52	87.2	71.3	79.3
September....	7.29	87.8	71.8	79.8
October.....	6.66	88.7	71.5	80.1
November.....	7.10	88.2	71.0	79.6
December.....	4.78	87.3	69.7	78.5
Total.....	63.03			

¹ Average of records for 71 years.

² Average of records for 17 years.

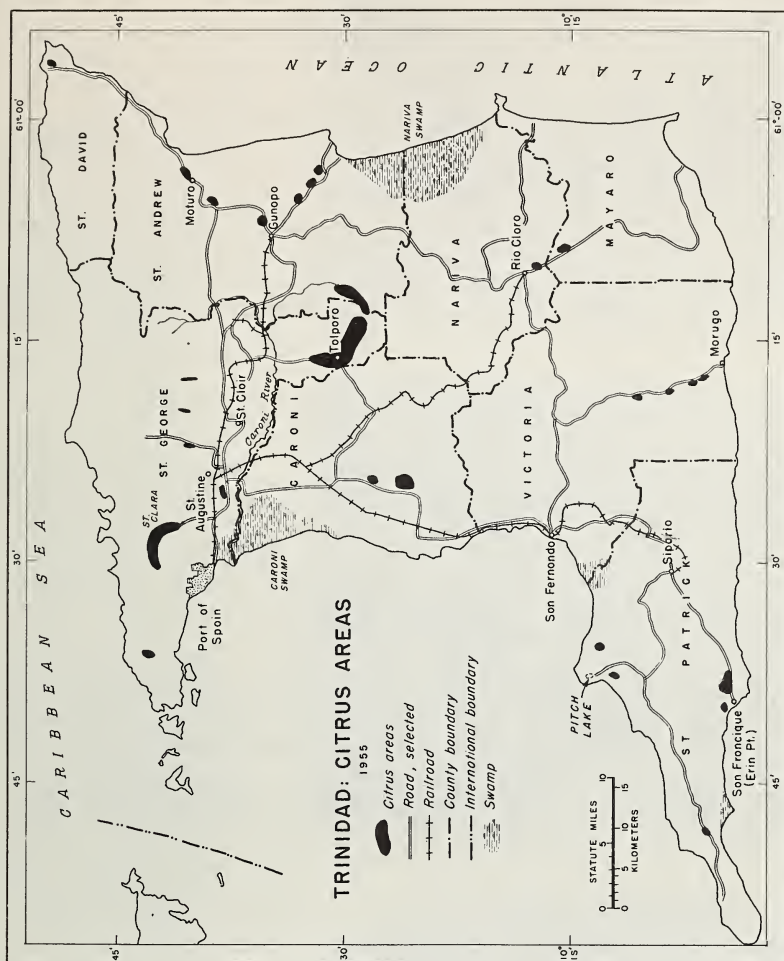
Source: Trinidad Department of Agriculture, "Rainfall of Trinidad," by F. M. Bain.

FRESH FRUIT

Cultural Conditions

Climate. --Many of the Trinidad citrus grower's problems are due directly or indirectly to the high humidity and rainfall of the island. One effect of this is the rapid growth and short commercial life of the trees, as in the Rio Grande Valley of Texas. The trees begin to bear in 2 years and in some areas reach maximum production in 10 years. In 25 years a tree has reached maximum growth.

The average humidity at the St. Clair experiment station



is over 77 percent every month in the year. The range in temperature is small; the highest average temperature in May--89.8°F. -- is only 3.4 degrees warmer than the average maximum temperature in January (table 1). The average rainfall is around 65 inches a year, even in the drier areas of citrus plantings; but in some sections average rainfall is over 100 inches a year. Cloudbursts occur in some areas, principally in valleys of the northern range. When this happens, roads are flooded and low-lying citrus orchards are covered with water.

During the season of heavy rainfall the ground is saturated with moisture and elaborate drainage systems are necessary to carry off excess water. Some soils, too, have naturally poor drainage. For these reasons, all citrus is planted on mounds. Because of the rainfall, fertilizers can be applied only during the dry season just before the rains in May. The dry soil will absorb the nitrates with the first rainfall, but any subsequent application of fertilizer during the period from June to December will be washed away.

The dry season, from January to May, when the average rainfall is less than 2 inches a month, is also the period of strong winds against which citrus plantings must be protected. A paradoxical factor in Trinidad's climate is that in spite of the high annual rainfall, there is a water shortage in the dry season. The towns must often ration water, and those citrus groves without irrigation systems have insufficient water to carry out a spraying program.

In some years with a prolonged dry season the trees suffer from lack of moisture in April and May. Heavy weed growth and shallow root systems make for rapid loss of soil moisture in the dry season. Groves observed in April 1955 were wilting, although only about a fortnight had passed since the last rain. In many grapefruit groves the foliage was so sparse that every limb was visible. Growers state that this leaf condition improves when the rains begin, but the exposure of the main trunk and limbs to the hot sun does not aid the tree. This may be why the older commercial groves give the appearance of abandoned groves.

Most orange trees are younger than the grapefruit, but seemed to have a better foliage cover. Lemon trees, however, had very few leaves, and every tree had gummosis.

Trinidad's main citrus season is later than that of Florida. There are usually two main blooms on Valencia oranges in a year of normal weather: the first in April and May and the second in June and July. The early bloom sets fruit which ripens in November and December; fruit from the later bloom ripens in the following April and May.

The pattern of bloom is somewhat similar for grapefruit except that the grapefruit matures earlier and has a season from January to April. In late April 1955, grapefruit was observed to be fully mature and dropping in the groves, while the Valencia orange was still in a firm condition showing little orchard drop.

The seedling orange trees or "cocoa" oranges usually have

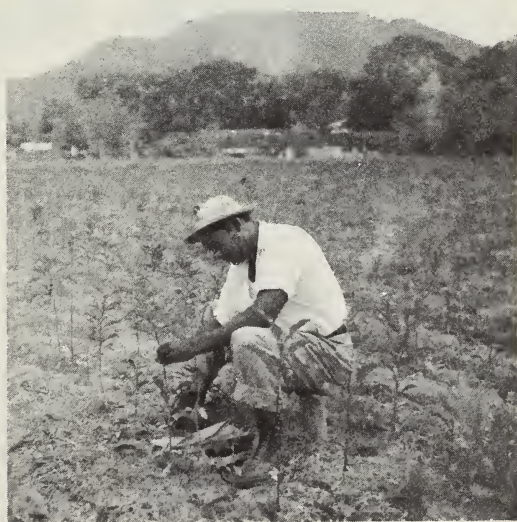
A commercial orchard of budded citrus trees in Trinidad, with the customary drainage ditch. Drainage has to be provided in Trinidad's orchards because of the heavy rainfall.



In the Department of Agriculture nursery near St. Augustine, Trinidad, seedling trees are raised in bins set up off the ground to prevent "damping off."



Worker at the Department of Agriculture nursery buds young citrus trees. Note how small the plants are when they are budded.





CITRUS DISEASES AND PESTS thrive in the warm humid climate of Trinidad. Gummosis (above, left) is found in nearly all orchards; psorosis (above, right) is not so wide-spread. Plant parasites have killed the grapefruit tree shown below (left); tree ants live in nests like that at the right, and make picking impossible unless nests are sprayed.



Citrus leaves damaged by leaf-cutting ants, which have been known to defoliate a tree in one night. These ants live in the ground and appear only at night, making control difficult.

but one bloom, in April and May, producing fruit that matures in November and December. In addition to these primary blooms, other flowering may occur during the year, usually when a dry period is broken. These out-of-season blooms produce some fruit the year round, but much of this is of a quality suitable only for the local market.

If heavy rainfall occurs when the trees are in blossom, little fruit is set. This is an important factor in the low average yields.

Cultural Practices. --Trinidad produces most of its citrus near rain forests. The weeds or vine crops grow rapidly and must be cut two to four times a year. After a rain, newly cut weeds develop a 3-foot new growth in 4 weeks. The groves have a heavy ground cover of weeds most of the year. Though this is necessary as erosion control, it increases the problem of fungus disease. The profuse plant life of many species and the warm humid climate create ideal conditions for a large and varied insect population.

To meet these cultural conditions, citrus is raised with rather simple cultural practices. The cover of natural weed growth is cut by hand in nearly all groves two to four times a year. This cleaning of the land is a major cultural task. The only exceptions to the hand cutting of the ground cover are found in the few groves that do not have drain ditches, where tractor-drawn cutters are used. Even here, weeds around and under the trees are still being cut by hand. This use of power tools is the exception and is likely to remain so. No spraying is done in most orchards, and little will be done in the future, for the frequent rains quickly wash spray material from the trees.

Pests. --Trinidad has unusual pest problems because of the high rainfall and the proximity of most orchards to the native forest. Plant parasites are serious pests, especially in areas where the annual rainfall is in excess of 75 inches a year. Scale insects, primary pests in most northern citrus areas, are not so serious here because of the high rainfall and a good degree of biological control which is obtained naturally. Ants are probably the most serious problem.

The leaf-cutting "parasol" ant lives in the ground on fungus fed by leaf tissue. These ants appear only at night; in a single night they have been known to strip a tree of its leaves. Besides cutting leaves, they girdle young orange trees to obtain the gum sap for repairing their nests. These pests are usually controlled by finding the nest and injecting sulfur bisulfide or Chlordane into the anthill. But their nocturnal habits make them difficult to combat.

The tree-living ant or tree termite builds a mud nest in the tree. Though it does not attack the leaves, its nuisance value is considerable. It feeds on other living parasites, such as aphids. Control is expensive, requiring the removal and destruction of each nest.

The black bee (Trigona trinidadensis) attacks ripe oranges, laying eggs that develop into larvae causing the fruit to drop.

These bees live in the rain forest near citrus orchards. The only control is to find the hive and destroy it, often an impossible task. Black bees are reported to be active on oranges in April and May, and after May oranges cannot be left on the trees. Large quantities of fruit have been destroyed by these important pests.

Florida red scale (*Chrysomphalus ficus*) is a serious pest on young trees, particularly on nursery trees. It is controlled by oil sprays. In mature orchards little spraying is done, a degree of biological control being obtained by entomogenous fungi.

West Indian red scale (*Selenaspidus amiculatus*), while sometimes present in nurseries and on young trees, is reported to do little damage.

The black citrus aphid causes some damage to new growth and young trees, but little control is practiced. This insect is the vector of the virus tristeza in affected citrus-producing areas.

Thrips and similar fruit-seasoning insects are active in many groves. Little control is practiced, however: the difficulty of transporting spray or dusting rigs in the groves and the cost involved make normal control methods unsuitable. Because of high rainfall, repeated applications of insecticides would be necessary, at prohibitive costs.

Plant parasites of many kinds flourish in this warm, humid climate. The only possible control is to clean the trees by hand periodically, picking off and destroying each plant. This can become a major expense, but if the plants are not removed they will eventually kill the tree. Among the parasites found are "wild pines" and epiphytes, or air plants. Experimentation is being carried out on chemicals to control all these plants, but as yet only partial success has been obtained, and few groves are so situated as to make spraying possible.

Diseases. -- Trinidad has a very serious citrus disease problem because of high rainfall, humidity, and the poor drainage of some of its soils. The problem is further complicated by the fact that many groves are planted on steep hillsides inaccessible to spray equipment. Groves planted on more level land have open, deep drains that make them equally difficult to spray. Heavy weed growth is a normal condition that prevents the dragging of spray hoses into the orchards. Even if these problems could be overcome, the frequent rains most of the year would quickly wash off any fungicide applied. The following are most of the diseases that are of commercial importance to the industry:

Gummosis, a very important disease, is to be found in nearly every Trinidad orchard. Widespread infections were observed, but orchard treatment did not seem usual. Orchards were seen where only inarching kept the trees alive, although the original tree was budded on resistant sour-orange rootstock.

Withertip of limes (*Colletotrichum limetticolum*), a fungus disease, attacks young growth and the blossom of

TABLE 2.--Representative citrus fruit sizes in Trinidad; one day's packinghouse run

Size	Number of boxes	Size	Number of boxes
Marsh seedless grapefruit:		Valencia oranges:	
64.....	652	150.....	272
70.....	1,660	176.....	365
80.....	2,960	200.....	333
96.....	3,432	216.....	418
112.....	1,596	252.....	305
126.....	1,166	288.....	115
150.....	321		
Total.....	11,787	Total.....	1,808

Source: Cooperative Citrus Growers' Association.

trees. Control by bordeaux spray is impractical because of the frequency of applications required. The disease is very widespread among limes in Trinidad.

Epidemic dying of limes is an unidentified disease of fungus which has been devastating Trinidad's lime orchards. Some trees are attacked from the top and progressively die back; some seem to die from infected roots. Trees budded on rough-lemon rootstock seem to be immune. A prominent planter, Mr. H. N. Fahey, has successfully rebudded a diseased lime grove to sweet oranges, and reports that if the disease is checked at the bud union, the sour-orange root budded to sweet orange is unaffected by the disease. This may show either that the root is resistant to the disease or that the disease is dormant.

The characteristics of the disease--dying back from the top, shedding leaves, and discoloration under the live bark--are characteristics also of "mal secco," the disease that has been so damaging to the Italian lemon industry.

Citrus scab was observed on grapefruit; some groves in areas of heavy rainfall had severe damage. The presence of scab disfigures the fruit and reduces its juice content. In the areas affected, no control measures were being taken because of the impracticability of spraying.

Melanose was present in most groves, and a large percentage of the fruit was disfigured by it. The damage to grapefruit seemed greater than the damage to oranges.

Psorosis has not been reported in Trinidad. However, unmistakable outbreaks of this virus were observed, one in the grove from which scion stock is being taken for the govern-

ment nursery program. No bud certification is practiced, and it may be assumed that the virus is present in both grapefruit and oranges.

Tristeza, or "quick decline," has not been identified in Trinidad, and no evidence of it was observed. The danger of infection is recognized by the industry, however. Not only is nearly all citrus on susceptible sour-orange rootstock, but the black-aphid vector is present, and the disease is reported in Venezuela only a few miles away.

Varieties. --The four citrus varieties of major importance to Trinidad are Valencia oranges, Marsh seedless grapefruit, Duncan grapefruit, and West Indian limes.

In commercial production but of less importance are "cocoa" seedling sweet oranges, Foster pink and other pigmental strains of grapefruit, King oranges, Femenillo lemons, Seville or bitter oranges, and citron. Trinidad groves also produce the following orange varieties, which have little commercial importance: Washington navel, Hamlin, Parson Brown, Shamouti, Lue Gim Gong, and pineapple.

Trinidad's citrus fruit is of tropical quality. Table 2 gives the pack-out of one day's packinghouse run, indicating a representative range of fruit sizes. The majority of the grapefruit was size 80 and 96. Only 44 percent was size 80 and larger; 56 percent was size 96 and smaller. Orange sizes were larger in comparison: 76 percent of the fruit was size 216 and larger.

Trinidad grapefruit has an acceptable size range for European markets. In quality, too, it is fairly competitive, although many of the fruits are marked by fungus and pests. The interior quality of the fruit is generally satisfactory.

Oranges tend to be larger than is desirable for the European market. Moreover, they have a green and yellow cast when matured, and are not easy to peel. The Cooperative Citrus Growers' Association of Trinidad and Tobago is experimenting with the use of artificial dyes to improve the appearance of the export fruit. Past experience has shown that tropical fruit of the quality produced in Trinidad can be sold in Europe, but the prices paid are lower than those for the highly colored, easy-to-peel fruit from the Mediterranean.

Government Assistance. --The Trinidad Department of Agriculture operates a well-housed and well-equipped central experiment station devoted to citrus and other tropical and subtropical plants. The station is located about 10 miles from Port of Spain, at El Carmen. At present the agricultural work in citrus is confined to experiments. There are no programs for extension work or for training in the field.

The station is carrying on an important and difficult experiment with six rootstocks budded to both grapefruit and oranges. It hopes to find a rootstock which is both resistant to tristeza and reasonably resistant to gummosis. Though the experiment is not yet complete enough to show conclusive results, preliminary findings with regard to gummosis are as follows:

Rootstock	Incidence of gummosis	
	In grapefruit	In Valencia oranges
	<i>Percent</i>	<i>Percent</i>
Sour orange.....	3.7	2.0
Sweet orange (wild sweet-seeded "cocoa" orange) ...	6.0	3.8
Rough lemon	9.3	6.0
Dominican wild grape- fruit.	1.9	9.3
Sampson tangelo.....	14.8	6.7
Cleopatra mandarin..	5.6	---

Results so far confirm that sour orange is the rootstock most resistant to gummosis. But if it becomes necessary to change rootstocks because of tristeza, either Cleopatra mandarin or the wild sweet-seeded "cocoa" orange might be used. If the "cocoa" orange proves a fairly suitable rootstock in this area, it might have some value to U.S. citrus areas seeking a substitute rootstock.

The Department of Agriculture also operates a commercial nursery at St. Augustine. This is a large establishment selling many kinds of fruit plants as well as ornamentals and vegetable plants. An estimated 75 percent of all citrus trees grown in Trinidad are produced in the nursery. The production is subsidized by the government: budded citrus trees that cost an estimated US\$.42 each to raise are sold for US\$.17 each. This is an important stimulus to citrus plantings. Since orders are greater than production, the trees are rationed out to each purchaser. Distribution of trees by this nursery in recent years has been as follows:

	<u>Grapefruit trees</u>	<u>Orange trees</u>
1949.....	33,745	44,108
1950.....	29,054	51,851
1951.....	29,319	57,989
1952.....	21,597	55,361
1953.....	17,148	61,924
1954.....	24,069	70,786

Source: Trinidad Department of Agriculture.

Of significance to citrus is a subsidy plan approved by Trinidad's Cocoa Board, for some of the present citrus acreage is planted on land formerly devoted to cocoa. The purpose of a part of the plan is to assist cocoa planters to plant other crops in areas unsuitable to cocoa. One of these crops is citrus. The extent of this assistance is indicated

in the following schedule, showing the subsidies approved by the Cocoa Board for citrus planting during 1947-53:

	<u>Citrus area</u> <u>planted</u> <u>(acres)</u>	<u>Amount of</u> <u>subsidy</u> <u>(US dollars)</u>
1947.....	693	106, 113
1948.....	253	47, 275
1949.....	291	51, 300
1950.....	249	34, 771
1951.....	168	22, 373
1952.....	151	20, 514
1953.....	166	26, 136
Total.....	<u>1, 971</u>	<u>308, 481</u>

Production

No official data are available on Trinidad citrus production. Estimates given in table 3 are based on the production reported by the Cooperative Citrus Growers' Association for its members; on exports to West Indian markets, which consist largely of fruit not grown by Citrus Association members; and on local consumption in Trinidad, roughly estimated.

The trend of grapefruit production has not changed greatly. New trees being planted probably about equal the loss of trees each year to disease. Orange production has shown a tendency to increase, and probably will increase further in the future as new plantings come into bearing. Crops of

TABLE 3.--Estimated production of oranges and grapefruit in Trinidad, 1948-54

[In thousands of boxes]

Year of bloom	Grapefruit	Oranges
1948.....	175	113
1949.....	552	203
1950.....	328	107
1951.....	337	170
1952.....	700	226
1953.....	396	110
1954.....	660	275

Source: Estimated by the writer. Grapefruit, Cooperative Citrus Growers' Association estimate, plus 10 percent; oranges, Citrus Association estimate, plus inter-island exports, plus estimated domestic consumption of 50,000 boxes per year.

TABLE 4.--Estimated citrus area in Trinidad, 1955

[In acres]

Item	Oranges	Grapefruit	Total
Bearing acreage.....	5,000	8,000	13,000
Nonbearing acreage.....	2,000	1,000	3,000
New plantings in the 1954-55 season.....	800	400	1,200
Total.....	7,800	9,400	17,200

Source: "West Indian Citrus Industry," Report of Fact-Finding Mission, Colonial No. 314, Feb. 25, 1955, p. 47.

around 500,000 boxes are possible by 1960.

Districts.--Citrus plantings in Trinidad are scattered over the island. The principal citrus area is in the rolling hills near the coffee and cacao plantations, where elevation ranges from 50 to 500 feet. Most of these plantings are within a 25-mile radius of Port of Spain; however, some fruit has to be hauled 60 miles from the groves to the packinghouse. One of the best groves is located at Erin, on the south coast about 60 miles from Port of Spain. Some of the most modern groves are in Caroni County, between the airport and Port of Spain, and on the road to San Fernando. The Santa Clara Valley, inland from Port of Spain, is another citrus area, but production in this section is declining.

Acreage.--Citrus plantings include estates of over 100 acres and small groves with an acre or so. About 90 percent of the grapefruit acreage is owned by the 280 citrus association members. About half the orange acreage is owned by the larger growers. The large groves, over 20 acres, are nearly all solid plantings of citrus, whereas most of the small groves are mixed plantings with coffee, bananas, corn, and other crops. The continued production of about 100,000 citrus trees a year by the Department of Agriculture indicates that present citrus acreage (table 4) may be expected to increase by about 1,000 acres a year. Indications are that new plantings will be primarily Valencia oranges.

Labor Requirements.--The labor required to care for a Trinidad citrus grove will depend on its location and the amount of rainfall. Where the rainfall is high, weeds and plant parasites grow rapidly and require more labor than where rainfall is lower. Some growers estimate that where the rainfall is 85 inches a year and over, one man is required for every 3 or 4 acres, while on lower, more level land where the average annual rainfall is about 60 inches a year, one man can care for 17 acres of land. On the average, it may be estimated that the 17,200 acres of citrus growing

in 1955 required about one full-time employee for every 5 acres, or about 3,500 workers.

An additional 1,500 workers may be employed seasonally in picking, packing, and marketing the crop. There are perhaps 500 small citrus growers with an acre or so who are partially self-employed in citrus cultivation. The total labor force in the Trinidad citrus industry, including seasonal and part-time workers, is roughly about 5,550 persons.

Costs. --Among the many problems the Trinidad citrus grower faces in controlling his costs of grove operation is the high labor load, due to the large amount of hand work required--about one man to every 3 or 4 acres--and to the low output per man. It is said that no one in Trinidad works more than 5 hours a day. Much of the cultural labor, therefore, is piece work, with a definite wage for a specific task. Some of the labor costs are as follows:

	<u>Unit</u>	<u>Cost</u> <u>(US dollars)</u>
Wage rates for field labor ¹ ...	Day	\$1.05-\$1.17
Piece rates:		
Digging 2' x 2' drains:		
In ordinary soil	100 ft.	1.46
In clay soil	..do..	1.75
Mounding earth for planting trees	..do..	.47
Cutting weeds	Tree	.07
Cleaning weeds from under tree to the drip	..do..	.10
Picking fruit and carrying it to orchard drive	Box	.06

¹ Applies to only a small percentage of the labor.

The cost of operating an acre of citrus with 70 trees might be estimated somewhat as follows:

	<u>Cost per acre</u> <u>(US dollars)</u>
Cutting weeds (twice a year)	\$9.80
Cleaning weeds under each tree to the drip	7.35
Repairing orchard roads	5.80
Cleaning out drains (once a year)	5.80
Cleaning ant nests from trees, and destroying ground nests of ants and bees	5.80
Treating gummosis	2.90
Cleaning parasite plants from trees	5.80
Fertilizer (8 lbs. sulfate of ammonia per tree)	11.70
Taxes	.15
Other expense	2.90
Total	58.00

Consumption and Marketing

The primary factor in citrus marketing in Trinidad is the Cooperative Citrus Growers' Association of Trinidad and Tobago. This organization, formed in 1932, has led the development of Trinidad's commercial citrus industry. The association is a semigovernmental organization in that it is a cooperative established under the Agricultural Cooperative Societies Act of 1931. The government approves the bylaws and furnishes two members of the board of directors. Association members must deliver all their citrus products to the association unless it gives them specific permission to do otherwise. However, membership is voluntary.

The citrus association is the only organization permitted to export citrus fruit from Trinidad. Fruit sent to the Caribbean area is not considered export, hence does not fall under this regulation. The association handles mostly fresh grapefruit and grapefruit juice and orange juice for export to Europe. The export of fresh oranges to the Caribbean is carried on by small traders, who obtain the fruit from small nonassociation growers.

In 1954 the association had about 280 members and controlled about 90 percent of the grapefruit production and at least 75 percent of the orange production. The many small growers--probably around 25,000--who sell their fruit to local traders for domestic consumption and the Caribbean market do not constitute an important commercial factor in the industry.

TABLE 5.--Representative retail prices of fresh and processed fruit in Port of Spain, Trinidad, April 1955

Item	Unit	Retail price.
<u>Fresh Fruit</u>		
Oranges:		<i>US cents</i>
King.....	Each.....	.02
Valencia, size 252 culls.....	...do.....	.02
Grapefruit, size 126 culls.....	...do.....	.01
<u>Canned Juices</u>		
Orange juice, single strength, 5% sugar added.....	#2 can....	.16
Grapefruit juice, single strength, 5% sugar added.....	{...do..... 48-oz. can	.09 .23
Blend, single strength, 5% sugar added.....	#2 can....	.12

Source: Personal observations in retail stores.



In most Trinidad grapefruit orchards, fruit is picked into bags, which are carried to boxes along the roadside (above); one grove at Erin has a tractor for ingrove transportation (below).





Partially packed box of grapefruit for export. Both oranges and grapefruit for export from Trinidad are packed like this in single-compartment Bruce boxes and fully wrapped in waxed diphenyl-treated Swedish paper.



Most of Trinidad's oranges are exported to the Caribbean area in cleaned, salt-fish barrels like the one shown here, with a slit cut in the barrel for ventilation.

TABLE 6.--Representative wholesale prices of oranges and grapefruit in Port of Spain, Trinidad, 1954

[In US dollars per box]

Month	Oranges	Grapefruit	
		White	Pink
January.....	\$2.62	\$1.37	\$1.72
February.....	2.33	1.37	1.72
March.....	2.33	1.54	1.89
April.....	2.33	1.54	1.89
May.....	3.50	1.72	2.75
June.....	5.25	2.06	3.09
July.....	5.25	2.06	3.09
August.....	6.42	3.09	3.09
September.....	5.25	2.40	--
October.....	3.50	2.06	--
November.....	2.62	1.54	--
December.....	2.62	1.54	--

Source: Queens Park Hotel, Port of Spain, Trinidad.

Domestic Consumption. --The domestic consumption of citrus is estimated to be about one-fifth of the orange production, but probably not more than 2 or 3 percent of the grapefruit production. Most domestic consumption is in the form of fresh fruit, but some juices are sold, and cans of Trinidad juice were observed in most retail food shops.

Nearly all the supplies come from small growers, who mostly sell the fruit on the tree to hucksters. The Marketing Board of Trinidad, which purchases fresh food supplies for the government, reports that in 1954 at its receiving depot in Port of Spain it paid growers an average of US\$2.52 per box for oranges and US\$.91 per box for grapefruit. These returns are probably somewhat higher than the average price, for this is the price of picked and delivered fruit and not the price paid by the hucksters for fruit on the tree.

Citrus fruit was observed to be widely sold and used, and domestic consumption is increasing. Retail outlets vary from the pushcart to modern "serve yourself" food stores. In one of these modern stores, the retail prices recorded in table 5 were observed during April. Considering the rather poor quality of the fruit, these prices seemed high, and the summer prices are even higher.

The domestic market for citrus in Trinidad is illustrated further by the wholesale prices of oranges and grapefruit throughout the year (table 6). From November to April the wholesale price for oranges is about US\$2.60 per box com-

TABLE 7.--Exports of fresh citrus from Trinidad, 1937-54

[In thousands of boxes]

Calendar year	Oranges ¹	Grapefruit ²	Limes ²
1937.....	19.4	46.9	1.9
1938.....	24.5	79.2	2.1
1939.....	9.1	22.3	1.0
1940.....	24.0	139.7	.3
1941.....	24.0	35.1	.9
1942.....	6.9	3.0	--
1943.....	.7	.8	--
1944.....	1.4	.7	--
1945.....	10.2	1.8	--
1946.....	19.1	2.8	--
1947.....	24.3	79.0	--
1948.....	67.4	208.7	.1
1949.....	19.9	74.8	--
1950.....	50.0	135.2	--
1951.....	39.8	87.9	.2
1952.....	30.2	76.8	.2
1953.....	68.8	175.1	.2
1954.....	48.1	95.7	.1

¹ 70-pound boxes.² 80-pound boxes.

Source: Trinidad, Central Statistical Office.

pared with US\$5.25 to US\$6.40 per box from June through September. These prices should result in excellent returns to the grower.

Grapefruit does not sell at such high prices, since it is a less preferred type. In the winter and early spring months, wholesale prices for white grapefruit ranged from US\$1.37 to US\$1.54 per box. In the summer when grapefruit are scarce, prices ranged from about US\$2.00 to US\$3.00 per box. The small quantities of pigmented grapefruit produced sell at somewhat higher prices--from US\$1.72 per box in January and February to a little over US\$3.00 per box in the summer.

Marketing Costs.--The cost of packing citrus in Trinidad is relatively high, since all supplies have to be imported. In the 1953-54 season, single-compartment wire-bound Bruce boxes purchased in the United States were being used for export shipments. Paper wraps were obtained in Sweden. The high cost of these materials is reflected in the total packing cost of US\$1.53 per box for grapefruit--a high cost, considering the relatively low wages paid. In addition, the freight rates effective in 1954 from Trinidad to the United

Kingdom were higher than those from other sterling areas. The tabulation below gives total estimated costs of marketing grapefruit in the 1953-54 season:

	Cost per box (US dollars)
Packing material and supplies.....	\$0.72
Direct packing costs	.38
Repairs and depreciation	.13
Overhead	.23
Transportation to wharf, and wharfage	.07
Total packing cost	1.53
Freight to U.K., ventilated stowage ¹	1.12
Total marketing cost c.i.f. U.K., excluding cost of fruit.....	2.65

¹ Cost of refrigerated stowage, US\$1.31 per box in 1954.

Source: "West Indian Citrus Industry," Report of Fact-Finding Mission, Colonial No. 314, Feb. 25, 1955, pp. 53 and 92.

Exports. --Trinidad has been exporting both oranges and grapefruit since before World War II (table 7). Grapefruit has always been the major citrus export item. Postwar exports are about twice those before the war, though they have not exceeded 210,000 boxes a year. Only small quantities of grapefruit are used in the West Indies and Trinidad. A large share of the total grapefruit exports is sent to the United Kingdom. It is interesting to note, however, that in 1954 a small shipment of grapefruit went to Western Germany (table 8). Oranges are exported primarily to neighboring West Indies countries. Only minor quantities of fresh limes are exported, and these go primarily to Caribbean countries and for utilization in ships' stores. Though limes were once an important citrus crop, disease has drastically reduced production and exports in recent years.

Trinidad's is not a one-bloom, one-crop industry. With several blooms a year, some fruit is exported each month. But over 90 percent of the grapefruit exports take place during the first 4 months of the year, and the small exports in other months are to Caribbean destinations. Orange exports do not have such a marked seasonal tendency; however, most exports occur from February through June. Trinidad's primary export season for both oranges and grapefruit coincides with that of the Mediterranean citrus-producing countries and also with that of Florida.

London auction prices of Marsh seedless grapefruit from Israel and Trinidad are compared in table 9. The Trinidad export box is about 25 pounds lighter than the Israeli box. Taking this factor into consideration, Trinidad grapefruit sold for about the same price per pound as Israeli fruit. This shows that the size of Trinidad grapefruit suits the British market well, with the smaller fruit bringing more per box than the largest sizes. On the whole, Trinidad grape-

TABLE 8.--Exports of fresh citrus from Trinidad, by country of destination, 1950-54

[In boxes]

Commodity and country	1950	1951	1952	1953	1954
Oranges: ¹					
United Kingdom..	5,714	--	2	19	86
Canada.....	2	2	3	--	--
United States...	--	1,270	--	--	--
West Indies.....	32,401	32,403	24,690	64,765	45,499
Others.....	11,902	6,163	5,515	4,070	2,485
Total.....	50,019	39,838	30,210	68,854	48,070
Grapefruit: ²					
United Kingdom..	131,400	81,994	72,748	166,999	83,726
Canada.....	7	9	8	8	7
West Germany....	--	--	--	--	2,008
United States...	--	1	--	--	--
West Indies.....	3,213	3,951	2,418	6,330	7,581
Others.....	634	1,929	1,630	1,737	2,367
Total.....	135,254	87,884	76,804	175,074	95,689
Limes: ²					
West Indies.....	--	4	1	20	--
Others.....	--	230	185	140	60
Total.....	--	234	186	160	60

¹ 70-pound boxes.

² 80-pound boxes.

Source: Trinidad, Central Statistical Office.

fruit seems capable of competing fairly well in European markets.

Trinidad exports fresh citrus to British Guiana, Barbados, and some of the other Caribbean islands. The trade is seasonal, and shipments are made to Barbados only when Dominican citrus is out of season. The fresh-fruit trade is usually carried on by hucksters who purchase fruit on the tree from the small grower at prices estimated at from one-half to 1 US cent per orange. The fruit for the Caribbean trade is taken to the docks and placed in cleaned salt-fish casks which hold about 1,000 oranges. This fruit is orchard-run grade.

Small sailing ships carry this cargo. The freight is US\$3.27

per barrel to British Guiana and US\$2.10 per barrel to Barbados. Trade sources report that in the 1954-55 season a barrel of 1,000 oranges brought about US\$11.67-US\$12.83 delivered in Barbados.

TABLE 9.--London auction prices of Marsh seedless grapefruit from Israel and Trinidad, Feb. 23 and Mar. 9, 1955

[In US dollars per box]

Size	Grapefruit from Israel ¹	Grapefruit from Trinidad ²
February 23, 1955		
64.....	\$5.46	\$3.36
70.....	--	3.50
80.....	5.60	3.64
96.....	5.88	3.92
112.....	--	4.06
126.....	--	4.06
March 9, 1955		
64.....	3.99	3.43
80.....	4.83	3.64
96.....	5.46	3.78
112.....	5.74	3.92
126.....	5.88	3.78
150.....	5.74	3.78
176.....	5.60	--

¹ In boxes of 94-106 lbs.

² In boxes of 70-73 lbs.

Source: London auction catalogs.

PROCESSED FRUIT

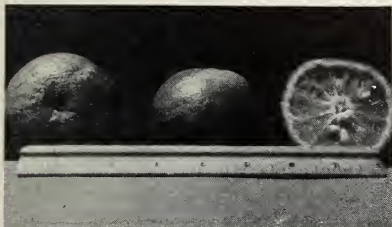
Production

The sole processing plant for oranges and grapefruit in Trinidad is operated by the Cooperative Citrus Growers' Association. This plant is located next to the fresh-fruit packing plant, and fruit to be processed is carried from one plant to the other by a conveyor. The plant is equipped with automatic juicing machines and apparatus for canning single-strength juice. The equipment is all of U.S. manufacture.

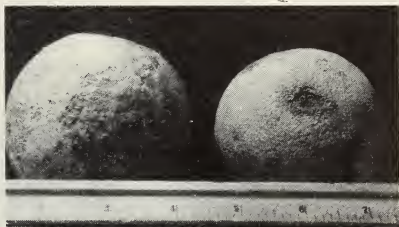
In 1954, it was evident that too much essential oil was present in the canned juice produced, and in 1955 machinery



Trinidad's Marsh seedless grapefruit (left) and Valencia orange (right). Both have interiors of excellent quality, but have disfigured peels.



The King orange is produced commercially in Trinidad, but is of less importance than the Valencia.



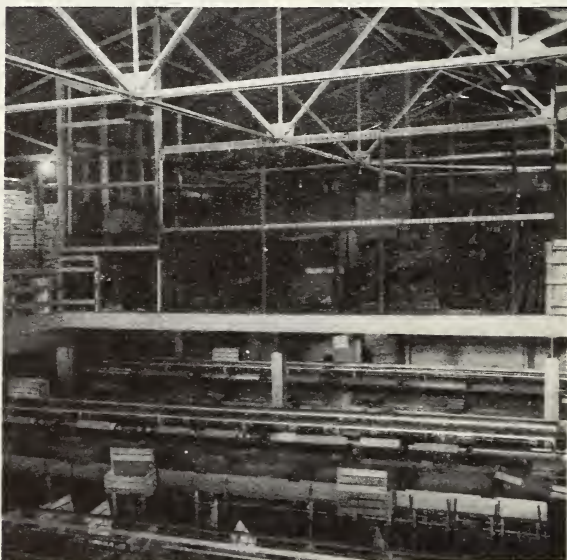
Grapefruit (left) is affected with scab, which reduces juice content; orange (right) has been stung with black bees, which makes the fruit drop.

Italian-type lemons produced in Trinidad. (The three at left are immature). Most trees are diseased and have a light leaf population.





The citrus-peel dehydrator operated for Trinidad's Agricultural Marketing Board to supply feed under a government program.



Fresh-fruit packing facilities at the plant in Port of Spain, Trinidad.

TABLE 10.--Exports of fresh citrus from Trinidad, total and by specified West Indian destinations, 1954

[In boxes]

Destination	Oranges ¹	Grapefruit ²
British Guiana.....	12,926	269
Grenada.....	247	--
St. Vincent.....	262	9
Barbados.....	26,069	7,009
St. Lucia.....	--	--
Bermuda.....	794	184
Leeward Is.....	--	--
Antigua.....	--	--
St. Kitts.....	--	--
Guadeloupe and Martinique.....	--	--
French Guiana.....	--	--
Curacao.....	5,201	110
Total.....	45,499	7,581
Exports to other countries.....	2,571	88,108
Total exports.....	48,070	95,689

¹ 70-pound boxes.

² 80-pound boxes.

Source: Trinidad, Central Bureau of Statistics.

was being purchased in Florida to extract essential oil prior to juicing. Though oil from grapefruit is of little value, it is hoped that some oil can be recovered from oranges as increasing quantities are processed. It is estimated that the capacity of the plant is about 350 boxes of fruit per hour. The plant operates at least two shifts a day and is hard-pressed to keep up with packing during the season. In the 1954-55 marketing season some grapefruit was left unharvested because the plant could not accept increased quantities of fruit.

Before the war, grapefruit segments were also canned. However, this was found to be unprofitable and the machinery has been dismantled and stored. Until recently, only single-strength grapefruit juice was canned, but small quantities of single-strength orange juice are now being produced in order to offer purchasers both types. Blended juice has also been canned, but has not proved popular in Europe.

No laboratory is operated at the plant, but tests are made for acidity in order to control the addition of sugar, since all juices produced are of the sugar-added type. In 1954 a peel-dehydration plant was installed at a cost of about

US\$225,000. An agricultural bank loan furnished the capital, which is to be amortized as peel is sold. The entire production of this plant is sold to the Agricultural Marketing Board to stimulate the use of this product as an addition to cattle feed in Trinidad.

There are many problems in the operation of a processing plant in Trinidad, not the least of which is that cans are received semimanufactured and have to be farmed at the plant. These cans cost about US\$.04 per No. 2 can when made up.

TABLE 11.--Exports of single-strength canned citrus juices from Trinidad, by country of destination, 1950-54

[In U. S. gallons]

Commodity and country	1950	1951	1952	1953	1954
Grapefruit juice:					
United Kingdom	18,055	427,865	199,455	586,395	723,302
Canada.....	1,051,115	259,202	317,208	900,091	62,065
New Zealand....	1,081	4,158	3,636	12,856	18,556
United States..	4	36	--	--	--
West Indies....	38,883	68,831	10,565	96,254	95,926
Netherlands....	27,120	--	--	--	--
Others.....	71,022	32,152	84,006	46,876	15,314
Total.....	1,207,280	792,244	614,870	1,642,472	915,163
Orange juice:					
United Kingdom	18	8,107	89,571	245,725	137,579
Canada.....	3,603	--	432	67,466	--
New Zealand....	--	3,585	1,870	20,591	18,015
West Indies....	18,328	9,263	15,399	18,067	40,718
Others.....	--	2,485	3,440	2,474	3,155
Total.....	21,949	23,440	110,712	354,323	199,467
Blended orange and grapefruit juice:					
United Kingdom	--	--	10	--	54
Canada.....	--	11,567	5,296	160,316	11,025
New Zealand....	--	2,598	757	5,372	8,107
West Indies....	--	22,152	12,758	12,185	9,519
Others.....	--	3,926	14,572	2,091	1,272
Total.....	--	40,243	33,393	179,964	29,977

Source: Trinidad, Central Statistical Office.

TABLE 12.--Exports of citrus products from Trinidad, total and by specified West Indian destinations, 1954

[U. S. gallons]

Destination	Orange	Grapefruit	Blend
British Guiana.....	24,140	27,383	2,252
Grenada.....	--	7,463	432
St. Vincent.....	757	2,828	216
Barbados.....	--	23,419	4,504
St. Lucia.....	840	5,253	--
Bermuda.....	9,728	137	54
Leeward Is.....	270	1,675	342
Antigua.....	1,802	11,530	1,261
St. Kitts.....	1,740	13,007	458
Guadeloupe and Martinique	--	1,267	--
French Guiana.....	1,441	1,964	--
Curaçao.....	--	--	--
Total.....	40,718	95,926	9,519
Exports to other countries	158,749	819,237	20,458
Total exports.....	199,467	915,163	29,977

Source: Trinidad, Central Bureau of Statistics.

Prices

In 1954, grapefruit juice was sold at US\$2.24 per case of 24 No. 2 cans f.o.b. Port of Spain. This, plus freight of US\$.28 and insurance of US\$.02, gives a c.i.f. cost of US\$2.54 per case in England. The price for a case of 24 No. 2 cans of orange juice was US\$3.43 c.i.f. England.

According to the report of the Fact-Finding Mission, the 1954 cost of processing single-strength juice amounted to US\$1.56 per case of 24 No. 2 cans. Of this, direct costs amounted to US\$1.27, repairs and depreciation to US\$.09, and overhead to US\$.20. Freight was US\$.32 per case to the United Kingdom or Canada and US\$.64 per case to New Zealand.

Exports

Table 11 shows the principal markets for Trinidad's citrus juices. The West Indies citrus-juice trade now ranks second in importance for each type of juice, and constitutes a new and sound export market for Trinidad (table 12). During 1950-54, exports of grapefruit juice to the United Kingdom in-

TABLE 13.--Exports of specified lime products from Trinidad,
1937-54

Calendar year	Lime juice	Distilled lime oil
	<i>U. S. gallons</i>	<i>Pounds</i>
1937.....	30,123	46,429
1938.....	89,777	33,403
1939.....	73,928	47,401
1940.....	133,120	49,373
1941.....	98,916	67,798
1942.....	55,545	41,039
1943.....	57,710	35,630
1944.....	72,967	32,870
1945.....	110,260	23,300
1946.....	100,302	16,604
1947.....	74,003	12,698
1948.....	10,647	31,461
1949.....	60,897	19,233
1950.....	14,464	6,534
1951.....	10,885	8,687
1952.....	5,386	5,798
1953.....	28,236	22,103
1954.....	6,911	5,967

Source: Trinidad, Central Statistical Office.

TABLE 14.--Exports of distilled lime oil from Trinidad,
by country of destination, 1950-54

【In pounds】

Country of destination	1950	1951	1952	1953	1954
United Kingdom.....	--	--	782	2,636	1,020
Canada.....	1,550	3,808	238	510	2,989
New Zealand.....	--	--	--	136	680
United States.....	3,944	4,130	2,380	17,296	--
West Indies.....	--	56	--	--	--
Other.....	1,060	693	2,398	1,525	1,278
Total.....	6,534	8,687	5,798	22,103	5,967

Source: Trinidad, Central Statistical Office.

creased and those to Canada decreased, especially in 1954, when Trinidad juices met severe competition from Florida

in Canadian markets. Exports to New Zealand have shown a steady increase, as have exports to the West Indies.

Total orange-juice exports have increased as production became available, and exports to the United Kingdom, New Zealand, and the West Indies have risen steadily.

Blended orange and grapefruit juice was first packed in 1951, and in 1953 over 179,000 US gallons were exported, primarily to the Canadian market. Exports of this type of juice were greatly reduced in 1954, as competition in the Canadian market restricted sales.

Exports of lime juice and distilled lime oil, formerly of considerable importance, declined sharply after 1949, when disease attacked the lime plantings. Until 1953 the United States was the most important market (tables 13 and 14).

